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OF THE

AMERICAN DENTAL ASSOCIATION

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BACTEREMIA FOLLOWING THE REMOVAL OF DISEASED TEETH

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IN the surgical treatment of periodontoclasia, whatever may be the technic of choice, as well as in the removal of infected teeth that manifest periapical involvement on roentgenographic examination, it has become more and more apparent that serious postoperative complications occur, particularly with reference to bacteremia, due to bacterial invasion of the blood stream by *Streptococcus viridans,* causing death in many cases from cardiac lesions, particularly subacute bacterial endocarditis.

Dentists in hospital practice exclusively are able to secure medical data from the clinical records of patients. They are able to consult the medical staff as to the previous or present history of a cardiac lesion, and thus anticipate complications. In private practice, the medical history of a patient is quite often not given sufficient consideration. In any event, such information is not so readily available.

A survey of hospital case histories or clinical records would doubtlessly reveal not a few deaths from year to year, due to bacteremia traceable to the removal of one or more teeth, or possibly due to extensive surgical treatment of periodontoclasia. The reaction is immediate in many instances.[1] Symptomatically, the patient complains of sweating, septic fever, weakness and mild prostration, with the temperature at normal during the morning, rising to about 101° F. in the evening. Blood cultures secured at this time will show *Streptococcus viridans* in a higher percentage of cases than was formerly thought possible. The next marked changes, noted in the necropsy reports, are seen in the conditions that are present in sepsis. Necropsy reports will many times note the presence of a serofibrinous exudate, the periapical surfaces having what is called a "shaggy appearance." Again, there will also be reported the presence of an enlargement of the pulmonary artery, many thrombi and grayish vegetations along the walls of the pulmonary artery. *Streptococcus viridans* is usually found in the pericardial exudate.

There are two dental sources of entry

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through the blood stream for the transmission of bacteria. Miller[2] states that the first is by bacterial penetration through defects in the coronal portion of the tooth, produced by caries, erosion or accident. The second source is the epithelial covering occurring at the junction of the gingival tissues and the crown of the tooth. The first mode of entry indicates that the path is through the pulp chamber and its contents, following extensive caries. From the dental pulp, the path extends on through the pulp canals to the adjacent tissues in the periapical area, where bacteria are picked up by the blood stream. The second portal of entry is pyorrheal "pockets," so-called, following alveolar destruction and exposure of wide areas of cementum on the root surfaces even to the extent that the apical third of the roots are involved.

Through this second portal of entry, a bacteremia is usually set up, following the surgical treatment of periodontal disease whether the treatment is a simple scaling of root areas, or more definite surgical débridement of infected membrane, epithelial tissue and diseased bone.

It is known that some periodontists who follow the latter technic with fairly uniform results do not attempt such treatment without a previous medical history as to the possible presence of cardiac disease, diabetes, syphilis, anemia or some other systemic disease. Dentosurgical treatment is then not advisable or attempted until after the patient has received proper medical attention, and should not be attempted until the physician indicates that the general health of the patient has sufficiently improved.

There is ample evidence from the writings of Rosenow,[3] Doyle and Henry[4] and others that *Streptococcus viridans* has been secured and isolated from a high percentage of non-vital teeth whether the x-ray findings were positive or not for the presence of an infectious or destructive process at the apices of teeth. In this contention is mentioned a review of an article by Russell L. Haden[5] published in 1926, wherein he outlined the results of a careful check-up of cultures of the periapical tissues of 1,500 teeth. Of this number, *Streptococcus viridans* was found in more than 92 per cent.

Palmer and Kempf[1] present a bacteriologic study of the results of blood cultures taken following the removal of one or more teeth. These cultures were taken from root apices, root canals, pulp tissue within the pulp chamber and tissue at the roots of numbers of diseased teeth of the deciduous dentition. Both were "impressed by the presence usually in pure culture of *Streptococcus viridans* in 90 per cent of the teeth from which cultures were taken," and they state that "beta-hemolytic streptococci, staphylococci and diptheroid bacilli were occationally found." In their technic, the teeth to be cultured were removed in as nearly an aseptic manner as possible. Roots were separated with a sterile saw and placed in 70 per cent alcohol for from three to five minutes. The specimens were next washed with two changes of physiologic solution of sodium chloride, then dropped into a tube of deep meat broth containing 1 per cent dextrose, fresh veal infusion broth with a cube of beef at the bottom of each tube, pH 7.4. Next the broth was streaked on blood-agar. To quote further:

> During the past year (1938) with Joseph A. Hopkins cooperating, we made blood cultures on eighty-two patients who had dental extractions under local anesthesia. We purposely selected patients who were not to have more than two teeth removed, and made no attempt to determine whether or not there was infection in the apical tissues. We were interested in learning the results of blood cultures of persons who had had one or more, but not more than two teeth removed for any reason. The teeth in our series were removed because they were "dead," diseased beyond repair, or for other reasons not related to this study. All the

patients had negative cultures of blood taken immediately before extraction. Fourteen of the eighty-five, or 17 per cent, gave positive cultures with blood taken immediately after extraction. In thirteen of the fourteen positive cultures, the blood was sterile ten minutes later. The other bacteremia case yielded organisms in the circulation ten minutes after extraction. This patient, a man aged 65 years, suffered from arteriosclerotic heart disease. He left the community soon after the extraction and passed out of our control. We learned that he had a continuous fever later and died after the extraction had been completed several weeks. In eleven of the cases yielding positive cultures, the organism was *Streptococcus viridans;* in two cases *Staphylococcus aureus* (hemolytic) was cultured; in the remaining case a diphtheria bacillus was recovered.

In experiments on endothelial permeability as influenced by the seasons, Petersen and Nedzel[6] present the theory from experimental findings that, in man, during late winter and spring, the endothelium in general is more permeable (simulated); while, in the summer and autumn, it is the reverse. They believe that their experiments and clinical data point out definitely that there are changes in the endothelium in the heart valves, especially of the left side, which render these valves "sticky," and thus more susceptible to bacterial localization, and that these changes from their findings are definitely connected with the seasons and pressor episodes. The appearance of bacteria in the blood at this time, they state, may lead to endocarditis.

Recently, at this hospital, I had under observation a fatal case of bacteremia. The case report follows:

REPORT OF CASE

History.—J. B. S., a veteran, white, aged 51, admitted to hospital in July 1940, was poorly nourished, apparently acutely ill and very anemic.

The patient had had three teeth removed in April and, during the early part of May, he began running a slight temperature. He also began losing weight. Later in May, he had had several more teeth removed. Shortly thereafter, because he complained of feeling very tired and had lost 25 pounds, he was admitted to another hospital. He was there placed on sulfanilamide, but it proved too toxic. Sulfapyridine was given next, and this was also too toxic in effect. About the middle of June, the patient became mentally confused.

Seven transfusions of blood of 25 cc. each were given from June to about the middle of July. The patient apparently improved and was allowed to leave his bed. Later, he became progressively worse.

The past history indicated a cardiac condition. During further treatment, he developed malaise, progressive weakness, anorexia and sweating. The white blood count was 44,800, with 90 per cent polymorphonuclears. The temperature was 100° F.

Examination.—On admission to this hospital, the red blood count was 3,790,000, with hemoglobin 55 per cent and small mononuclears 12 per cent. The laboratory report July 31, 1940, on the blood culture, was positive for *Streptococcus viridans,* which was of heavy growth in pure culture. Petechiae of the skin later developed.

Dental examination revealed parodontal disease, a well-advanced pyorrhea. There were many so-called "pus pockets," and certain areas from which a number of posterior teeth had been removed some time previous to hospitalization here.

Diagnosis.—The medical diagnosis was endocarditis, subacute bacterial and mitral insufficiency.

Outcome.—Death occurred August 12, 1940.

Necropsy Report.—The pericardium and surfaces of the heart appeared normal in size and shape. Routine dissection of the heart revealed a normal appearing pericardium.

The coronary arteries showed a small amount of atheroma, but were entirely patent. The aortic valve and the proximal aorta also showed some atheromatous change. The tricuspid and pulmonary valves were normal.

Attached to the upper aspect of the mitral valve near its base was a rather firm vegetation about 1.5 cm. wide and 0.5 cm. thick, extending out from the valve about 2 cm. The free edge of the mitral valve was thickened and nodular. Just above the base of

the vegetation, there was a perforation about 3 mm. wide in the mitral valve.

The spleen was large and soft and weighed about 500 or 600 gm. The lower one-third was fluctuant and consisted of a sac containing bloody liquefied splenic pulp. The upper two-thirds contained several small areas of infarction, and, on the upper lateral surface, there was a large subscapular hemorrhage.

The splenic artery was opened, and, in the large descending branch, just as it enters the spleen, was a partially organized thrombus that occluded the vessel. Distally to this was the area of septic liquefaction necrosis mentioned above.

At a point near the hilus and toward the anterior border of the spleen, there had been a rupture, which apparently communicated with the artery which had been occluded.

The anatomic diagnosis was subacute bacterial endocarditis *(Streptococcus viridans)* of the mitral valve, with an embolism and thrombosis of a large branch of the splenic artery, leading to septic infarction of the spleen, resulting in a perforation, and a massive fatal abdominal hemorrhage. A terminal bacteremia was shown by blood cultures positive for *Streptococcus viridans* prior to death.

A review of the postmortem records of this hospital from 1934 to 1940 shows a series of nine cases of bacteremia in which the anatomic diagnosis was bacterial endocarditis, with a previous history in the clinical records of cardiac disease. These findings were almost identical in all of these cases, as to the presence of calcification or thickening of the valves of the heart, acute or subacute ulcerative and vegetative endocarditis, hemorrhagic infarctions of the spleen and other organs.

Of this series, two cases are particularly interesting because one had a previous history of the removal of ten teeth before hospitalization, while the second case gave a previous history of severe tonsillitis. A history of the first case, including a dental history, follows:

A white man, aged 38, was admitted to hospital May 7, 1937, with a diagnosis of cardiac disease, mitral valvular insufficiency. An infected tooth had been removed December 19, 1936, with subsequent dental treatment until February 8, 1937. Thereafter, the patient complained of pain in both legs, and influenza. He continued to feel weak and tired, with chills and muscular pains and, April 28, 1937, nine teeth were removed. The condition became progressively worse and the patient was removed to this hospital.

At the time of admission, there was a high temperature, with fast pulse and weakness and the patient had had several chills.

Examination of the mouth revealed an absence of many upper teeth, with a discharge of pus from around several remaining teeth. The remaining teeth were also carious. A laboratory report of May 8, 1937 was positive for *Streptococcus viridans.*

Death occurred May 24, 1937, and the necropsy findings[1] reported that the pericardium was larger than normal and adherent to the heart, with fibrinous adhesions. Mitral valves were found to be the seat of old sclerotic changes probably occurring in childhood, with a recent superimposed acute and subacute bacterial process of the vegetative type which had almost destroyed them.

No definite changes in the valves were noted except those due to myocardial damage and dilatation. The myocardium also showed evidence of marked damage. The anatomic diagnosis was subacute and acute bacterial endocarditis of the mitral valves, superimposed on an old chronic rheumatoid process, resulting in pancarditis and general bacteremia. A blood culture taken before death showed a heavy blood stream infection with *Streptococcus viridans.*

In the second case, with a previous history of an attack of severe tonsillitis, which was felt to be the onset of the subsequent condition, a history was given which is briefly presented as follows:

A white man, aged 30 years, admitted to hospital July 7, 1935, with a diagnosis of valvular heart disease and mitral stenosis, years previously had suffered from a severe tonsillitis and a peritonsillar abscess. In January 1935, he complained of migratory pain and swelling of the joints, with tenderness involving the metatarsal and phalangeal joints of the right foot. Pain lasted one week, with

mild attacks in these joints later on. Following this were attacks of dyspnea and palpitation after exertion, progressive weakness and shortness of breath.

Mouth examination made at the bedside after admission to hospital showed that the teeth were very unclean, their condition indicating that the mouth had been neglected over a long period of time.

The patient died in August 1935. The postmortem findings[7] reported complete obliteration of the pericardium with adhesions. The aortic valve was the seat of a chronic, as well as a recent inflammatory process, with an opening very irregular and slitlike. An extensive active ulceration was present involving the thickened sclerotic valves. A small area of ulcerative endocarditis in one of the mitral valves was noted.

The spleen was markedly enlarged, the tissues resembling that of the so-called acute cloudy swelling spleen.

The anatomic diagnosis was chronic valvular heart disease, rheumatic type, and subacute ulcerative endocarditis superimposed on chronic lesions of the aortic and mitral valves, causing marked mitral insufficiency and stenosis. The pathologic process found is consistent with, and strongly suggestive of, a septicemia, or bacteremia due to *Streptococcus viridans,* superimposed on an old rheumatic heart lesion, which apparently developed in 1926 when the patient suffered a severe attack of tonsillitis.

Complications of such a serious nature as bacteremia following the removal of teeth, or the treatment of periodontoclasia, indicate clearly that some form of premedication under the direct control of a physician should be the rule where there is a previous history of an endocarditis. The administration of some one of the sulfonamide derivatives such as sulfapyridine, or the new preparation known as sulfathiazole, would seem to be indicated, the choice depending on the bacteria found in the blood stream. Indications from the literature are that sulfathiazole is less toxic than the other preparations and its use is attended with less nausea and vomiting, and that the determination tests for the presence of free sulfathiazole in the blood, after proper dosage, give the same results. It is repeated that the premedicative measures to be taken in dental treatment in endocarditis, together with the necessary blood counts and urinalyses, must be completely under the control of the patient's physician, and no removal of teeth should be attempted until the physician indicates that it is safe to begin removal of the teeth.

CONCLUSIONS

1. The removal of dental foci, whether periapical or from other parodontal lesions, is indicated if there is a previous history of endocarditis. However, no such attempt should be made without securing a medical history, and then not until medical advice has been secured from the patient's physician.

2. Bacteremia is an entity in a far larger percentage of cases in which dental surgical measures are employed than is supposed, even when one or two teeth have been removed or treatment for periodontoclasia is undertaken.

3. Premedication by the use of some one of the sulfonamide derivatives would seem to be essential in these cases.

4. No evidence of endocarditis being found, and the body defenses being apparently adequate, the presence of a bacteremia is of negative importance, and dental surgical procedures are indicated for the removal of teeth in treatment of periodontoclasia.

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U. S. Marine Hospital, Twelfth Avenue and Judkins Street.

RÔLE OF THE ORTHODONTIST AND THE GENERAL PRACTITIONER IN THE TREATMENT OF JAW FRACTURES

By PAUL A. RISK, D.D.S., Lafayette, Ind.

IT is interesting to note that while today, with the increase in speed of travel, there has been an increase both in the number of jaw fractures and in the seriousness of these injuries, a majority of jaw fractures probably are not the result of traffic accidents.

Typical of the almost universal inadequacy in handling jaw fractures a few years ago is this summary in a textbook on oral surgery published in 1923.[1]

While there is no question that an accurately made interdental splint fulfills the requirements of fixation once it is inserted, yet the making of a splint demands considerable experience, at least two days of time devoted to nothing else, and involves some expense. Most cases of fracture of the lower jaw occur in persons in poor circumstances who apply for treatment to free dispensaries or dental colleges, where students have to be depended upon for the making of splints. Busy dentists, even though experienced in this work, cannot give up everything and devote at least two days to the making of a splint. Dental students have other duties, such as operative work and lectures to interfere, and moreover are insufficiently experienced to produce accurate splints in the desired length of time. For these reasons, it has been our experience that usually from two to three weeks elapse between the taking of the impressions and the insertion of the splint, which may not fit accurately even then. In the meantime, unless some other means of fixation has been used, the fracture may be in process of union in malposition. Therefore, for the fixation of the average case of fracture at the present time, we do not depend on splints, but employ immediate ligation of the lower to the upper teeth, thus reducing and fixing the fracture the first time the case is seen.

Even today we have only partially set aside teachings of this nature.

During the last several years, dentistry has made tremendous strides in orthodontic technic, in partial denture technics and in general prosthetics. During the same years, the orthopedic surgeon has added materially to the mechanical aids that he uses in the care of fractures in general.

The principles that best serve in the treatment of fractures as a whole apply in complicated mandibular or maxillary injury. These principles may be summed up in the words prompt and exact immobilization.

In the care of these cases, the problem is not only to obtain prompt and exact immobilization, but also to do so with a minimum of manipulation of the injured parts, at the same time giving the pa-

Read before the Section on Orthodontia at the Eighty-Second Annual Meeting of the American Dental Association, Cleveland, Ohio, September 10, 1940.

tient the greatest possible amount of freedom of action during the convalescent period.

Even before a decision is made on the mode of treatment, some one has to decide who is best qualified to apply these rules of care.

Accident cases are usually sent to the most convenient hospital. The medical man, usually in the person of the general surgeon, sees these patients soon after admission. It is this surgeon who decides whether he will assume full care himself or will call in others to assist him.

Since these cases are admitted to all general hospitals, the general practitioner, both physician and dentist, near the small county seat hospital, as well as the specialist in the large city, is called.

The care of fractures of the bones of the lower part of the face has resolved

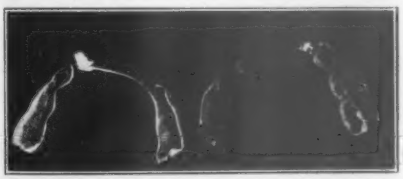

Fig. 1.—Left, occlusal view. Right, splint from below.

itself into a question of how best to apply the recent advances in orthopedic procedures, orthodontics and prosthetic dentistry.

As the orthodontist in a group dental practice, I have attended a considerable number of these accident cases, and I now wish to present a series of cases to illustrate my attempts to apply recent dental advances in the treatment of jaw fractures. Two early cases stand out as of special interest:

In the spring of 1927, a man, aged 45, presented himself for treatment of a fractured jaw. Examination revealed that only four teeth remained, the lower cuspids and second molars. The upper jaw was edentulous. There was a compound fracture through the left mandible in the bicuspid area. Cast splints were made and cemented to the teeth early the next morning. The fractured segments were then immobilized by passage through tubes and the splint sections of a threaded wire, which was then held in place by a single nut.

Infection delayed union. At the end of a year, there still was insufficient union to permit the removal of the appliance. Contact with the patient was then lost, but he returned nearly a year later with the appliance still in place. Twenty-two months after injury, there was a fair union and the appliance was removed.

Fig. 2.—Splint on duplicate model and disassembled.

In 1927, I was called as a consultant to see a child 4½ who, ten days before, had been in a railroad crossing accident. The child, nervous, even hysterical, had recovered sufficiently from a cranial fracture to permit care of a compound fracture of the mandible between the cuspid and lateral incisor. There was considerable displacement at the line of fracture. (Fig. 1.)

Under ether anesthesia, modeling compound impressions were taken, and cast overlay splints were made. Two days later, under ether anesthesia, the splints were ce-

mented in place. Again, a threaded wire and nut served to aline and fix one side to the other. The patient was at once able to chew lightly.

In these two cases, we were forced to splint one side to the other, because immobilization by ligation of the lower teeth to the upper was impossible.

Hydrocolloid impressions and an improved casting technic resulted in better and lighter castings. An appliance used in 1936 in the case of a young woman illustrates this change. (Fig. 2.)

A compound fracture through the socket

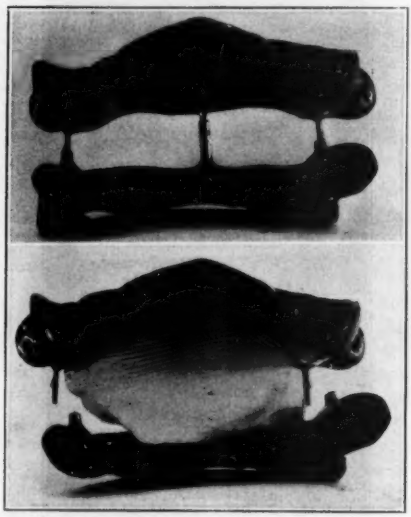

Fig. 3.—Splint as seen from distal aspect, locked in corrected occlusion; showing amount of lateral displacement present.

of a lower cuspid and fractures of the alveolar process supporting the four lower incisors were evident. The lower cuspid in the line of fracture had been lost. The dental care then consisted of removing the lower incisor teeth and fragments of alveolar process, and suturing the intra-oral lacerations. Hydrocolloid impressions were then taken. Splints were constructed that day and cemented in place early the next morning.

Each half of the splint carried a piece of 0.040 tubing. As the threaded wire was run through these tubes, it was also run through a predetermined length of tubing placed between the two sections of the splint. With tightening of the nut, the fracture was reduced.

The splint permitted the mouth to close with the teeth in normal occlusion. It had been so constructed as not to interfere with occlusion during chewing movements.

Permitting the patient to do light chewing during convalescence added greatly to her comfort and freedom of action.

A great variety of injuries are seen by the dentist who is called frequently to assist with these cases. No one type of appliance or even several types of appliances will serve. If the orthodontist is to be called by surgeons in his locality, he

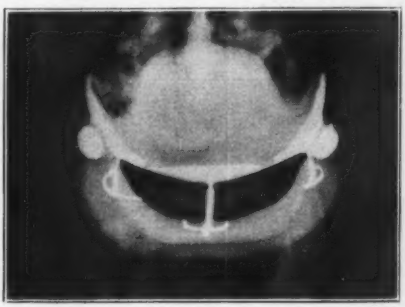

Fig. 4.—Splint in position; anterior-posterior view.

must take the cases as they appear and cannot select those that are more properly cases for the orthodontist from among those that might also be cared for by the oral surgeon or prosthodontist. Several edentulous cases illustrate this point.

Several years ago, in the case of an elderly man with a fracture through the molar region of the mandible, the problem was simple. After repair of the dentures, the anterior teeth were removed and arch wire was vulcanized between the upper and lower dentures to maintain the original bite. The denture was inserted and a chin bandage applied.

A very different problem was presented, several years ago, in a man aged 40, who had arrived in a local transient camp during the night and was referred to our office the following morning. He reported that he had fractured the mandible ten weeks before, and that an open reduction had been attempted soon after injury.

Considerable lateral displacement of the chin, lack of union and anesthesia of the mandibular nerve anterior to the fracture were noted. Roentgenograms were taken, and the marks of the attempted open reduction could be clearly seen in the lateral view. The lower denture had been cut down distally to the right cuspid to keep it away from the line of fracture.

Fig. 5.—Appearance of patient when splint was removed, traction bars being replaced that they might be photographed.

When the local transient camp director was told that care would be complicated and must include hospitalization, the patient was ordered transferred to the camp convenient to the university medical center hospitals. Eighteen days later, he appeared in the waiting room again, this time stating that he had merely been on the hospital waiting list and wished to be treated.

By this time, there was a firm union, with the chin off center. The mandibular anesthesia persisted. The bite was quite different from the bite which the dentures indicated to be normal.

In an attempt to restore the original bite, an impression was taken, to restore the full length of the lower denture. Next, splints duplicating the restored dentures were constructed and tubes and posts provided for locking the upper and lower splints together while the bite as it was before injury was duplicated. The three parallel tubes were set in the lower splint section, while the opposing posts were placed in the upper. Stops soldered to the posts controlled the depth to which a post might be inserted in its tube. With the posts in position in the tubes, off-center holes were drilled through the tubes so as to notch the posts. By the passage of wire ligatures through these holes when the posts were in position, the upper splint section was locked to the lower in a position duplicating the bite before injury.

Fig. 6.—Multiple fractures of light edentulous mandible.

Comparing the completed splint, mounted to duplicate the original bite, with the splint mounted to duplicate the bite after injury, we see the degree of correction asked from the appliance. (Fig. 3.)

Cast tubes were vulcanized in the upper portion of the splint to provide a means of applying traction between the upper splint section and a head cap, if it should be found necessary to hold the upper splint section in place.

To provide a precision fit between each traction bar and its tube, elliptical bar material was used, and the tubes were cast from wax patterns of the bars to be used in them.

A hole for locking the traction bar was provided. Both this locking device and the

off-center hole in one of the tubes are easily seen. (Fig. 4.)

Under local anesthesia, the lower splint section was fixed in the mouth by circumferential wiring.

Hypodermic needles with 0.025 inside diameter were cut down to serve as cannulas. Two stainless steel ligature wires, one 0.010 and one 0.011, were passed through the cannula each time it was inserted. The wires were ligated over the lower splint section at the midline and in the first molar region on each side.

Fig. 7.—Splint in position.

Fig. 8.—Types of clamp bands.

Next, we cut down through the scar left by the attempted open reduction and exposed the healed fracture. The mandible was refractured by prying with a blunt instrument in the old fracture line. We then inserted the upper splint section with traction bars in position, and locked the two splint sections together. (Fig. 5.) The traction bars were then ligated to a head cap. The next day, it was found that the traction bars were not needed. As the shape of the upper alveolar ridge held the upper splint section in place, traction bars and cap could be discarded. The appliance was removed in one month. There was then a new, firm union. The traction bars were replaced in position so that they might be shown in the photograph taken at the time that the splint was removed. Exact immobilization may account for our success, while lack of immobilization may explain failure of treatment at the time of injury.

Several months ago I was called to the hospital to attend a man aged 65 (Fig. 6), who presented multiple simple fractures of a very light edentulous mandible. Splints were made by reproducing the dentures in clear acrylic resin. The lower half of the splint was fixed in position by circumferential wiring and then ligated to the upper half of the splint. To protect the lips,

Fig. 9.—First splint in position.

rubber tubing was placed over the ligatures from two of the circumferential wires to the extension from the plaster cap. (Fig. 7.)

It is interesting to note here that the roentgenogram of the splint in position immediately after reduction shows only the metal parts of the splint.

Clear acrylic resin casts no x-ray shadow. This very much simplified the x-ray studies of the union of this very light mandible. The upper part of the splint was removed in eleven days. The head cap was discarded in twenty-eight days and the lower splint removed fourteen days later. Several weeks after the splint was removed, the lines of fracture could no longer be seen in the roentgenogram.

In making appliances for the immobilization of fractures, the several sizes of Russell locks used either on individual bands or on cast splints have been the most useful of the several comparable types of orthodontic attachments. (Fig. 8.)

When I have used individual bands, the clamp band has usually been found more satisfactory than the cemented band. The clamp band may be fitted with much less manipulation of the injured part and it eliminates the possibility of loss of cement in a laceration.

After a clamp band made of light material has been fitted roughly on the plaster model or in the mouth, a final fit is assured if from 0.5 to 1 mm. is taken out of its circumference. This can be accomplished by cutting through the tubing that is to serve as the locking device. Flat tubing and threaded wire were used in making most of the clamp bands shown.

A dental consultant, if necessary, should be called as soon as the general condition of the patient permits. By this, I mean that if there are no contraindications, the dental consultant should see the patient while he is still in the emergency room, and not a day or two later.

A girl aged 16, admitted to the hospital, presented severe lacerations of the face and lips. The chin was so collapsed upon the throat that both breathing and swallowing were difficult. The roentgenograms only partially indicated the extent of the injuries, which included extensive intra-oral lacerations, fractures of the upper and lower alveolar process and the loss or displacement of three upper molars, one lower molar and the four lower incisors. A comminuted fracture at the symphysis and fractures through one condyle and the upper ramus on the opposite side were also present.

My part of this patient's care included extensive intra-oral suturing as well as the removal of the several displaced teeth and numerous bone fragments. Hydrocolloid impressions were then taken. This first part of the treatment was complete at about 11 o'clock that night. The extent of the lacerations of the lips indicated that anything that we wished to do in the mouth must be completed within the few hours; i.e., before swelling would force a wait of perhaps a week.

The next morning at 11, cast splints were cemented to the lower teeth. Each splint section included a 0.040 Russell lock. One side was fixed to the other side by 0.036 steel arch wire in the Russell locks. The mandible was then ligated to the maxillae. In this case, the extreme mobility of the segments contraindicated, if it did not render impossible, banding and ligation of individual teeth. The roentgenogram taken after reduction shows a fragment of cement in the line of fracture. (Fig. 9.)

Fig. 10.—Second splint with steel arch bar as worn for two months.

On the seventh day, clamp bands were placed on the upper first bicuspids. The articulation of the lower teeth with the upper was improved by adjustment of the lower arch bar and the addition of new intermaxillary ligatures. At the end of four weeks, the appliance was removed. By this time, that is at the end of four weeks, the posterior fractures were united. Infection, however, had prevented union at the symphysis.

New impressions were taken and the splint was remade. The condition at the beginning of treatment, which had prevented the taking of a really good lower impression, had

passed. The threaded wire and nut used in the Russell locks permitted easy control of the distance between the two sides. (Fig. 10.) A 0.036 steel arch was soon substituted for the threaded wire and nut. This splint differed from the one made immediately after the accident only in that it was so constructed as to require no cement. Better impressions permitted us to take advantage of undercuts rather than cement to hold the appliance in place. A heavy piece of band material set in a wax pattern at the distal portion served to hinge each casting. Tubes were placed in the wax at the mesial portion. After the castings were polished, a disk was used to cut through the mesial tubes. The open hinge thus formed then permitted the castings to be snapped to place. A threaded wire through a tube and a lock nut to clamp each splint to the teeth entirely eliminated the possibility of displacement. Light chewing was at once possible. Intermaxillary ligatures were no longer needed.

Fig. 11.—Splint in place.

Delayed union at the symphysis required that this new splint be worn for two months. It was removed three months after injury. One year after injury, a record of the condition was made for presentation in court.

A similar appliance served when the mandibular injury involved only the alveolar process and the displacement of the lower incisors and their supporting process.

A boy aged 16 had knocked out his four upper incisors and two lower lateral incisors. (Fig. 11.) The lower central incisors were displaced. It was thought that there might be enough process attached to the central incisors that they could be saved.

Three cast splint sections were clamped to the teeth. The central incisor section carried hooks for ligatures. The two outside sections carried 0.040 Russell locks. A 0.036 arch section was locked in the Russell locks. The middle section was then ligated lightly to the arch bar through the Russell locks.

Perhaps the most interesting case in the series was that of a man aged 23 who had been injured in a traffic accident three years previously. His injuries included a comminuted fracture of the anterior mandible, fracture of the left condyle and fracture of the right condyle and the right coronoid process. One lower lateral incisor had been knocked out and the other three lower incisors had been displaced, but were supported by a sizable bone segment. Again,

Fig. 12.—Three cast splint sections locked in position on reassembled model.

severe lacerations indicated that any work in the mouth must be accomplished in a few hours or swelling might force a delay of as much as a week.

The full upper denture that the patient had been wearing had been broken in his mouth, had been spit out and had burned with the wreck. There was also a fracture across the left tuberosity.

Since there were no general symptoms, hydrocolloid impressions were made immediately after first aid care and x-ray examination. (Fig. 12.)

The splint was applied and the anterior fractures were reduced at 4 o'clock that

afternoon, less than ten hours after the patient was admitted to the hospital. Molar 0.022 Russell locks and 0.022 arch were used instead of the usual 0.040 locks, to permit greater ease in adaptation of the arch wire.

Vincent's infection, noted on the fifth day, delayed the attempt to improvise a substitute for the upper denture until the eleventh day. (Fig. 13.) This substitute shown for the upper denture was inserted on the twelfth day. When ligated to the lower splint, it served to immobilize the posterior fractures of the mandible. The splint was removed in seven weeks.

after injury. Intermaxillary wiring was used, but, after two weeks, the general mouth condition required that all wire ligatures be removed. (Fig. 14.)

A one-piece vulcanite splint, made from models poured from hydrocolloid impressions, was substituted. The two buccal sections were hinged to the lingual section with heavy band material. A single ligature through the labial sections at the midline locked the appliance in place. A slight error in occlusion, present when the appliance was removed, was of no consequence, as the mouth was soon to be prepared for artificial dentures.

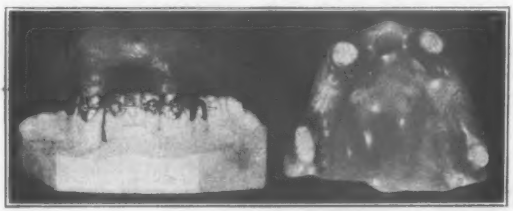

Fig. 13.—Left: Vulcanite substitute for upper denture ligated to lower splint. Right: Occlusal view.

Fig. 14.—One piece vulcanite mandibular splint.

Where a one piece casting is clamped to two or more teeth, the casting is seated either by taking advantage of the elasticity in the metal or by waxing a piece of heavy band material in one end of the wax section so that it may serve as a hinge in the completed appliance. By setting all attachments in the wax pattern, we both simplify the problem of alinement and eliminate all soldering.

Recently, a fracture through a lower cuspid area was complicated by severe chronic gingival inflammation. The patient presented herself for treatment several days

Recently, I was called to attend a man aged 45 with a comminuted fracture of the mandible involving the whole area between the right lateral incisor and the right second bicuspid. The two lower right incisor teeth were loosened, but not displaced. The lower right cuspid and first bicuspid supported by a segment of alveolar process were displaced. The upper right first bicuspid was chipped and loosened.

Worn occlusal surfaces to serve as guides to occlusion were absent. Missing teeth, malocclusion, including an end-to-end bite, and chronic gingivitis further complicated the problem.

Hydrocolloid impressions, one upper and two lower, were taken as soon as the surgeon completed the first aid care of miscellaneous lacerations. Cast splints bearing 0.040 Russell Locks were constructed for the two major segments. (Fig. 15.)

The next morning the splint was put in place. To provide full space to the segment bearing the right cuspid and bicuspid, the two splint sections were locked to the teeth by ligatures through loops at their open ends instead of by threaded wire and nut.

A 0.032 steel arch bar was then locked in the Russell locks, fixing one side of the mandible to the other. Next, the small center segment was lightly ligated to the arch bar. Again, a splint was in place and the fracture was reduced within twelve hours after admission of the patient to the hospital. A slight error in occlusion was apparently due to misplacement of some of the many small bone fragments near the lower border of mandible between the two principal segments. (Fig. 16.)

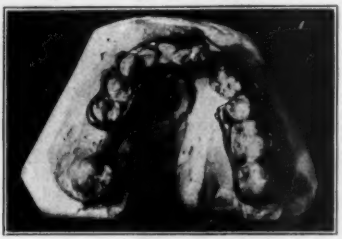

Fig. 15.—Two cast splint sections ligated to second lower model; middle segment ligated to arch bar.

On the sixth day, a steel arch 0.032 previously annealed to the upper model was ligated to the upper teeth. Intermaxillary elastics were then applied. On the eighth day, the patient left the city, returning on the twenty-eighth day, when all appliances were removed. Slight spot grinding corrected a minor error in articulation.

As a last example of some of the problems of fracture care, I should like to describe the case of a man aged 44 who presented a fracture through the lower incisor region extending across the roots of the left cuspid and first bicuspid, and a second mandibular fracture distally from the last molar on the right side. The four lower incisors were displaced lingually.

The maxilla presented multiple lines of fracture. Separation at midline had resulted in a 1-inch traumatic cleft in the palate.

My part of the patient's care consisted of ligating a steel spring arch to the upper teeth in an attempt to reduce the width of the bone cleft while the surgeon attempted to close the soft tissue opening. An arch wire was ligated to the lower teeth and the mandible was ligated to the upper arch.

Ten days later, the two lower left incisors were removed. At that time the lower arch was changed in an attempt to improve articulation. On the eighteenth day, the upper right lateral incisor was removed.

On the twenty-seventh day, the wire arches and all ligatures were removed. There was then union of the posterior mandibular fracture. Upper and lower hydrocolloid impressions were taken. Because of the failure of the attempts to close the cleft in the palate surgically, a cover of clear acrylic resin was made for this cleft. Lack of union of the anterior mandibular fracture necessitated that one side of the mandible be splinted to the other and, at the same time, permit the patient to wear the cover for the cleft in the palate. (Fig. 17.)

The splint consisted of a band supporting a 0.040 Russell lock cemented to the right cuspid and a cast clamp splint also carrying a similar Russell lock, locked on the left cuspid and left first bicuspid. This cast splint was open at its distal end. A carbon point through the wax model from which this splint was cast provided the tube for the wire locking ligatures.

The two remaining lower incisors were ligated to the 0.032 steel arch bar. Because of delayed union, this splint, put in position on the twenty-eighth day, was worn until the eightieth day after injury.

My experience indicates that a splint clamped tightly to the teeth may be left in position for longer than a month without danger of permanent enamel stain. Should it be desirable for a clamp splint to remain in position for an extended period, it is a simple matter to add cement, and clamp the casting back in position while the cement is still soft.

The earlier splints just shown were cast from coin silver. More recently, they have all been cast from economy gold, selected gold scrap or casting gold.

In selecting the cases to present here, I have chosen those that best illustrate the fact that injury of this type often requires much more than consultation with a dental intern or with an oral surgeon. They require that splints be made with the same precision that the prosthodontist demands of partial dentures. They require that orthodontic principles, if applicable in the case, be employed and prosthetic procedures of some years ago, technics no longer considered good dental practice.

The ability of the dental consultant to apply advanced orthodontic and prosthetic principles is as important as, if not more important than, his knowledge of oral surgery.

It is for the surgeon to determine whether the general condition of the patient will permit immediate dental care. Cranial fracture and shock are the usual reasons for delay. If the patient's condition permits early care, the dental con-

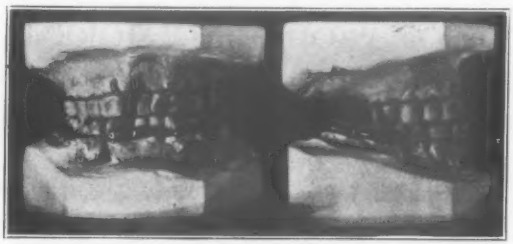

Fig. 16.—Intermaxillary elastics providing traction between lower splint and upper arch.

Fig. 17.—Cleft in palate after twenty-eight days; occlusal view of splint.

with the exactness that we expect in a carefully constructed orthodontic appliance.

A recent original article by a surgeon[2] describes numerous advances in the care of jaw fractures, but still speaks of ligating an arch made from a piece of coat-hanger wire to the lower teeth to immobilize one side of the mandible to the other.

The textbooks of today,[3, 4] when they describe the care of fractures of maxillary bones, all too often describe orthodontic

sultant should usually be called while first aid is being administered. In laceration of the lips, a delay of only a few hours may mean that swelling will force a further delay of at least a week.

It is essential that the dental consultant either have, or have access to, a well-equipped dental laboratory and that this laboratory be available at all hours. Reliance on a commercial dental laboratory which normally operates only during certain hours of the day is not sufficient

It is essential that the dental consult-

ant, if he is to be called frequently, be willing to rearrange his office time schedule when a call comes in. He must be willing to see these cases at all hours. The surgeon desires dental assistance with such cases as are here described. My experience has been that he wishes the dental consultant to take over and assume full responsibility, and that the amount of responsibility that this dental consultant is asked to assume is limited only by his own willingness and ability.

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Schultz Building.

METHODS OF PRODUCING MORE LIFELIKE DENTURES, INCLUDING THE PREPARATION AND PROCESSING OF ACRYLIC RESINS

By WALTER J. PRYOR, D.D.S., Cleveland, Ohio

THE art of constructing lifelike dentures is progressing at a faster rate at the present moment than at any time in the history of dentistry.

The invention of porcelain teeth, more than a century ago, followed by the discovery of the use of rubber as a denture base material, marked a definite improvement, but, during the past century, there was no outstanding development in the esthetic phase of denture work, with the possible exception of the use of porcelain to imitate the gum tissue, until the work of J. Leon Williams in awakening the profession and the tooth manufacturer to the need of better tooth forms.

Both of these efforts were only partly successful, since the general use of porcelain in fabricating the denture base is not practical; and while, owing to Dr. Williams' work, better tooth forms were made available, we still struggled along with the unsightly pink rubber gum and unnatural appearing porcelain in teeth.

Our plan, of necessity, was to keep the rubber gum out of sight and to stain and alter the porcelain teeth to produce more lifelike effects. At this moment, however, tooth manufacturers are changing their whole system of constructing porcelain teeth, and, owing to the discovery of the plastic methyl methacrylate, the use of rubber and other plastics as denture base materials is rapidly decreasing.

The changes made in the character and light refraction of porcelain teeth are such that I find myself now using teeth made by several different manufacturers where formerly one source of supply was sufficient.

Heretofore, no manufacturer had more than five or six so-called shades that were even usable. Now, each seems to

Read before the Section on Full Denture Prosthesis at the Eighty-Second Meeting of the American Dental Association, Cleveland, Ohio, September 11, 1940.

have just a few molds, which are really lifelike in appearance, and each seems to produce something excellent in color that the others lack. These new teeth require far less special preparation, such as tinting and staining in the process of producing fine dentures, than the older tooth forms.

No less important is the remarkably lifelike effects obtained by the use of the acrylic resin bases. Here again, a translucent effect is possible in an artificial pink gum that leaves little to be desired.

It is now possible to match the gums of the individual patient. Some patients require a dark, while other require a light, pink, and the addition of more coloring or more clear acrylic resin provides an effective means of fulfilling this requirement. The dentist who has an appreciation of art and color can produce dentures that are remarkable for their lifelike appearance. It will probably be a great many years before methyl methacrylate is superseded by any other plastic.

A simple system which has proved practical consists in coloring a stock of acrylic molding powder much too deep a pink for regular use and adding to this stock varying amounts of clear or uncolored powder, to produce varying shades of pink. By the addition of a small amount of titanium dioxide, a more opaque denture can be produced. This is advisable in some partial denture cases in which it is desired to prevent the metal framework from showing through the plastic.

In working out a color scheme, we find that the use of madder lake concentrated, 1 part, as the basic red, with iron oxide, 1 part, to modify it, and titanium dioxide (a white pigment), 5 parts, to produce a pink tint and also the desired degree of opacity, will result in an excellent series of pinks. These ingredients are well triturated with a small quantity of clear acrylic polymer or molding powder in a mortar with a pestle. Then more clear acrylic resin is added and the whole rotated two or three hours in a ball mill. Longer milling will give greater opacity and will also add a slight light brownish tint to the pink, which is desirable. This highly colored stock is set aside to be toned down with varying amounts of clear acrylic resin as preferred.

Condensed and cured properly to

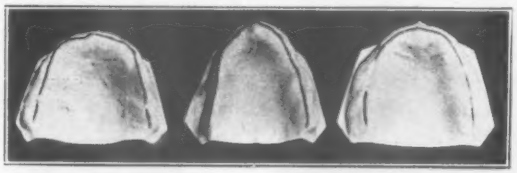

Fig. 1.—Square, tapering and ovoid edentulous ridges, which serve best for determining arrangement of artificial teeth.

A B C

Fig. 2.—Casts of natural teeth, showing (A) square, (B) tapering and (C) ovoid arrangement of teeth.

overcome to a practical degree its one shortcoming, namely shrinkage, there is no doubt that methyl methacrylate makes the best plastic denture base developed to date. It possesses adequate strength and is easily processed. Recent developments in apparatus and technic have for practical purposes eliminated porosity, warpage and the breaking of porcelain teeth in the curing or polymerization process. Any variation from these results can be laid to the failure of the operator in following a very simple technic, to be described later.

However, having available excellent teeth and denture base material does not render the production of fine dentures automatic, since improper placing of the

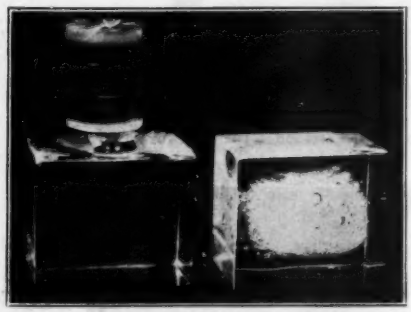

Fig. 3.—Perfectly clear block of acrylic produced in injector flask and (at right) rod cured in ordinary flask. The porosity would not be readily detected if the acrylic were colored.

teeth will ruin the appearance of any case.

Our foremost consideration here is that the mouth and lips of the patient shall assume their most natural appearance when the face is in repose with no teeth showing.

In meeting this requirement, it is necessary that the teeth be set in their proper relation to the ridges. This demands, first, that the proper amount of jaw separation be established. In determining this position, I know of no method more practical than the use of the operator's sense of beauty and proportion.

Secondly, it is necessary that the proper amount of overjut be provided for so that the teeth will set neither too far forward nor too far back under the ridge.

While many cases require little or no overjut, a commonly observed mistake is to set the upper anterior teeth too far back so that they meet the lower incisors almost edge to edge, in the case which demands considerable overjut.

The second requirement also calls for the proper tilting of the incisors inward or outward from the perpendicular.

Up to this point, we have not even considered the type of tooth to be used,

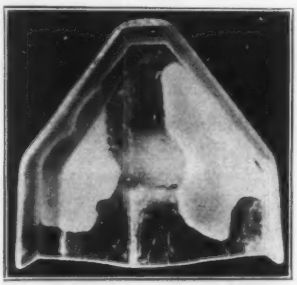

Fig. 4.—Transparent base showing amount of colored acrylic injected during curing into mold which had previously been packed full of clear acrylic.

but no tooth however beautiful will salvage the case if the foregoing requirements have not been met.

SELECTION OF TEETH

In selecting teeth, I regard tooth size of the greatest importance, tooth color next and tooth form third.

A common mistake made in the selection of teeth in the order of their magnitude is the use of teeth that are (1) too small, (2) too light in color or (3) of unnatural form.

A misconception has grown up in the profession that artificial teeth should be

smaller than the natural teeth. A similar misconception on the part of patients leads them often to request the use of smaller and lighter colored teeth than the case demands. A scrap book of motion picture stars showing large prominent teeth provides an easy means of convincing the patient that he perhaps really wants a different type of tooth.

Years ago, Dr. Williams, in his first advice to me as a young dentist with prosthetic aspirations, was to use anterior teeth large enough, even though it was necessary to leave off a posterior tooth

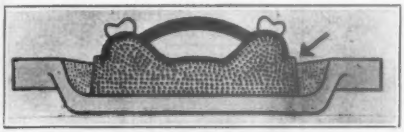

Fig. 5.—Cross-section of waxed-up case invested. The arrow shows the shoulder which provides a locked mold.

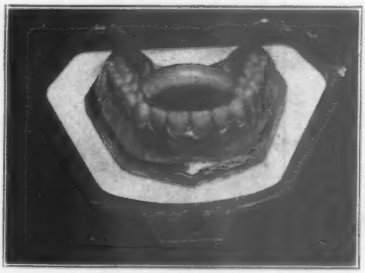

Fig. 6.—Upper invested case waxed and foiled ready for pouring balance of flask.

to do so. Years of observation has shown me the wisdom of that advice.

Dr. Williams' second suggestion was to reproduce the irregularity of the patient's natural teeth unless such irregularity constituted a deformity, in which case the irregularity should be toned down only enough to assure a more pleasing result, while retaining the patient's individuality.

Some of the so-called improvements on Dr. Williams' tooth carvings were actually the opposite, being throwbacks to more unnatural forms. I am referring mostly to the cuspid tooth. Since some of the manufacturers, however, have been alert enough to pay proper attention to this important tooth, the pressure of competition will take care of that matter. I find that the tooth manufacturer is much more responsive to the prod of competition than to any amount of free advice from the prosthetist.

The general practitioner, in the final accounting, was largely responsible for the unsatisfactory porcelain teeth available until recently. He purchased the

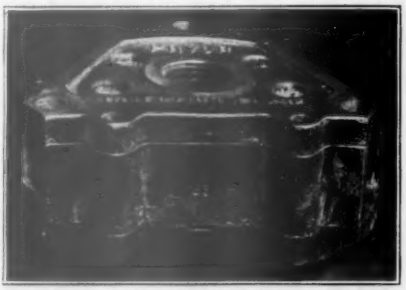

Fig. 7.—Injector flask for curing plastics.

Fig. 8.—Screw cylinder, piston and jam lock-nut.

wrong teeth or accepted them from the dental dealer or laboratory, and the manufacturer simply was guided by the sales figures.

Actually, the largest selling mold of tooth in the very recent past was a tooth that I have never once found occasion to use in several hundred cases of immediate dentures, wherein the patient's natural teeth were accepted as the model.

The safest procedure for the man interested in producing natural appearing dentures to follow is, when possible, to build all cases as immediate dentures.

You will then find yourself arranging teeth in alinements that you would never have conceived of.

Using the knowledge and experience gained in immediate denture cases, one will find himself doing better work in the cases in which he has not had the advantage of seeing the patient's natural teeth.

It will also be found that, very often, the face form does not correspond with the tooth form.

If we have not seen the natural dentition, arch form will prove a much truer guide than face form. (Fig. 1.) I pay much more attention to the shape—square, tapering or ovoid—of the upper

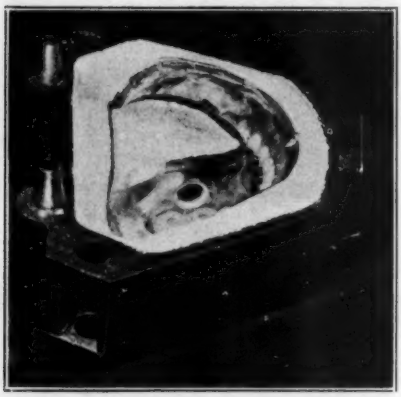

Fig. 9.—Lower case with wax boiled out, showing sprue channel opening.

edentulous arch than I do to the shape—square, tapering or ovoid—of the face or porcelain teeth.

Given the proper tooth size for the case, almost any effect desired can be assured by tooth arrangement and a little grinding at the incisal edges and occasionally at the cervical portions of the teeth, if the preferred tooth is not available. (Fig. 2.)

Ordinarily, it is not good practice to overlap upper anterior teeth unless the arch is narrow and constricted. Nothing looks more out of place than crowded, overlapped incisors in the case of a well-developed ridge or arch, which was, no doubt, large enough to accommodate good-sized teeth without crowding.

Spacing of anterior teeth should not be resorted to unless the patient originally presented this abnormality, and usually when spacing is resorted to, the width should be reduced.

Gold fillings and crowns should not be

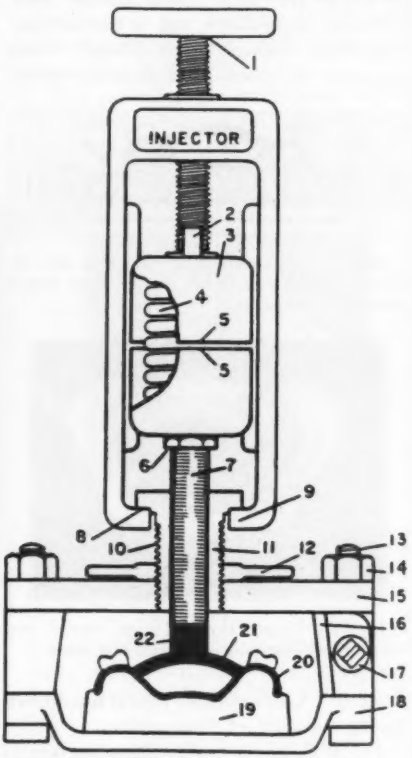

Fig. 10.—Cross-section of flask with injector assembly attached. 7, piston; 21, sprue; 22, reservoir.

used unless the natural denture exhibited such patching and, when used, should be reduced in number. It should be remembered that orthodontists and general practitioners are kept busy correcting such conditions in the natural dentition.

Successful portrait painters work for

general effect rather than minute detail, and so should the prosthetist. However, let me offer a few suggestions in regard to the treatment of the individual porcelain teeth. In all cases, at least the glaze, and often some porcelain body, is removed from the cervical or root portion of the upper anterior teeth with a saucer-shaped carborundum stone followed by a fine black carborundum paper disk. This is done for two reasons: 1. The collar is sometimes too broad and may cause the overlaying plastic gum material to be too thin for either appearance or wear. 2. It is occasionally desirable to expose a small amount of the root section of the porcelain tooth, and we all understand that there is no glaze on the root of a natural tooth. Therefore, a glazed root on a porcelain tooth is extremely unnatural in appearance.

Fig. 11.—Injector, showing spring in its housing.

Small facets of varying shape may be ground on the labial surfaces. These facets are also polished with the fine carbodisk, followed by the rag wheel and pumice. Shallow erosion areas can be simulated in the same way.

Sharp scratches to imitate enamel checks may be cut in the labial surfaces with a small knife-edge diamond cutter drawn quickly across the surface while rapidly rotating. These scratches usually take just a small amount of stain.

The incisal edge requires special treatment. It should rarely be ground off at a right angle, but should rather be ground off at an acute angle to the labial surface of upper incisors and cuspids, and at an obtuse angle to the labial surface of the lower incisor, as the natural teeth usually wear. This also provides a sharper incising edge.

Usually, a trifle more is cut away progressively as we grind from the mesio-incisal angle to the disto-incisal angle.

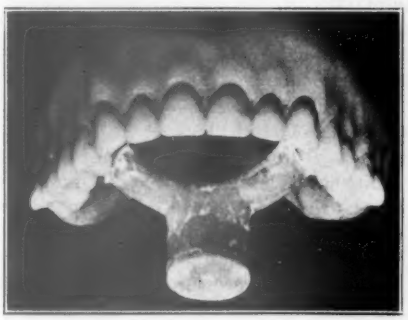

Fig. 12.—Processed denture before cutting away of sprue.

It is well to cut each tooth at a slightly different angle, because the natural teeth are usually set in the jaw with some degree of irregularity and the incisal edges are prone to wear at varying angles.

Often, no cutting at all has been done on the incisal edges. These cases represent unfinished business, as they are lacking both in appearance and in balance, being inserted just as they came from the laboratory.

Ground incisal edges should always be finished with a fine carborundum paper disk and polished with the rag wheel and

pumice to prevent the sharp edges from chipping off. Staining to reproduce defects and fillings in the natural teeth will always remain an effective means of concealing our handicraft and deceiving the public in favor of the patient, whose grateful appreciation makes our work so worth while.

BASE MATERIALS

The introduction of the plastic methyl methacrylate as a denture base material has proved to be one of the outstanding advances in the history of denture prosthesis. Certainly, no single development in the esthetics of this branch of dentistry outranks it in importance. In this material, we have a base combining both strength and a remarkably lifelike imitation of the natural gum, a combination that has been missing in all of many materials used in the past.

In the face of a major defect, shrinkage, which manifests itself in porosity, checking of teeth, lack of fit and faulty occlusion, this plastic has crowded vulcanite and all of the other plastics into the background in the short space of three or four years.

In the new method of curing, instead of applying the pressure to the outside of the flask, we exert the pressure directly on the curing plastic, and further, by maintaining firm spring pressure on the reservoir of uncured material, extra plastic is constantly injected into the mold, and the errors mentioned above are avoided.

In our former technic, this pressure was largely lost, even in a spring press, the moment the fin of excess hardened, a reaction which took place before the denture itself had hardened. This chain of events allowed excessive uncontrolled shrinkage to take place, and often resulted in porosity (Fig. 3), checking of the teeth and changes in the established occlusion of the porcelain teeth.

Improvements in both technic and plastic had partially overcome the above-mentioned shortcomings, but now, with the recently introduced injector flask technic, we are able to control this shrinkage to such a degree that, for practical purposes, our problem is solved.

Beginning about 1875, several dental flasks embodying some element of the injection principle have found their way into the records of the U. S. Patent office, but none of them has found a place in practical prosthetics, because of imperfections in the application of the injection principle. It was recognized that the perfect denture mold must be a closed mold if a high degree of accuracy was to be obtained in reproducing the wax pattern, but no practical method of filling the mold and keeping the plastic under proper pressure during curing was devised until the past year. This new technic not only fills the closed mold perfectly, but, through the continuous application of sufficient spring pressure during the curing process, additional plastic is injected into the mold, thereby reducing shrinkage to a minimum so as to meet all practical demands. (Fig. 4.)

In pioneering work with the acrylic resin base, it was found that, by packing the mold over-full with rather stiff plastic, making several trial closures, followed by careful repacking, and finally closing under heavy pressure in a spring flask press, checking of teeth and porosity were brought under control. In so doing, however, an equally great trouble was encountered, in that the occlusion of the teeth so carefully worked out on the articulator was often badly distorted owing to imperfect closing of the flask on the stiff plastic, or the posterior teeth were forced downward into the investing plaster of Paris. This was an extremely unsatisfactory situation, and the problem was to get the flask perfectly closed first and, at the same time, provide means of keeping the plastic under heavy pressure.

A description of the technic and the

apparatus used to accomplish this end follows.

ACRYLIC RESIN TECHNIC

The waxed-up case is invested well down in the lower section of the flask, where heavy tinfoil is applied to entirely cover the wax and about one-half of the labial and buccal surfaces of the teeth.

We prefer to cut the plaster away, exposing about one-eighth inch of the side of the stone cast, which has previously been shaped to a slight taper. (Fig. 5.) This taper provides a locked mold when the middle section of the flask is poured. Before pouring, however, a roll of pink baseplate wax about one-fourth inch in diameter is luted to the tinfoil just below the first molar tooth at both ends, forming a bridge from right to left. (Fig. 6.) In very heavy cases, an extra roll of wax may be extended to the anterior palatal region.

When melted out, these wax sprues form gateways to the mold. When the middle section of the flask is poured, the level of the plaster of Paris is brought just to cover the occlusal surfaces of the teeth. With the finger, the plaster is wiped away exposing the occlusal surfaces and also the top of the wax sprue where it arches across from side to side.

The lid of the flask, which has a threaded 1-inch opening in its center, is now placed in position and a bronze cylinder threaded to enter the opening is screwed into place. (Fig. 7.) This cylinder receives a half-inch piston of stainless steel, which is now placed in the cylinder and pushed down until it rests on the exposed part of the pink wax sprue. (Fig. 8.) With the piston held down in place, the cylinder is unscrewed until its hex head contacts the shoulder at the head of the piston.

A jam nut on the cylinder is now screwed down firmly against the lid of the flask to hold it in this position, where it prevents the piston from entering too deeply into the flask. The lid is now removed, the balance of the flask is poured with plaster or stone and the lid again pressed firmly into place.

When the case is boiled out, the heavy foil is pierced and the sprue channels are located. The foil is cut away from these openings, and, with a sharp knife, a disk of foil about 2 mm. greater in diameter than the sprue opening is removed. (Fig. 9.)

Before the wax is boiled out, the cylinder and the piston are removed, a hole, formed by the piston, being left in the investment, to be subsequently used as a reservoir from which plastic can be forced into the mold. All frail edges of plaster of Paris are cut away from the openings of the sprue channels before the final washing out of the mold with boiling water.

With the plastic of choice, mixed according to the directions for that particular material, the case is packed in the usual way and a trial closure is made. The use of cellophane, first wetted, then dried in a towel, will prevent the plastic from sticking to the cast. A slight underpack is advocated because if any excess material is squeezed out laterally in the trial closure, it must all be painstakingly cleaned away from the investment in order to permit the two halves of the flask to come together perfectly without any pressure. A cool or only slightly warm flask is favored because it provides more working time with the plastic. It may be necessary to add more plastic after the trial closure, but it should be slightly less than full. The one trial is all that should be necessary.

It will be found that, during the trial closure, the plastic has backed up, filling the sprue channels and often the reservoir as well. In some cases, the plastic may work back so far as to interfere with screwing the cylinder to place; in which case, some of the plastic should be removed. Now the flask is bolted shut, with firm pressure on the three bolts.

The cylinder is screwed to its originally

established position and enough plastic is packed into it so that the piston, which is now placed, stands out beyond the head of the cylinder for a distance of about one and one-half inches.

The injector (Fig. 10), which contains a stainless steel spring of the proper strength, is now placed in position, engaging the hex head of the cylinder. (Fig. 11.) The injector screw is turned down until the upper and lower halves of the spring housing come almost in contact.

The case is allowed to stand on the bench for about five minutes, the operator tightening the screw down on the spring to the almost closed position once or twice if the space opens. In very heavy cases, it may be necessary to remove the injector and piston and add more plastic if the piston seems to be penetrating to nearly its full length.

The case is now placed in a pan containing just enough cool water to immerse the lower third of the flask. This precaution is necessary because we must prevent the heat from reaching the reservoir of acrylic resin until the last, in order to keep it plastic and so that the maximum desired results can be obtained from the injection process.

The water is brought to a boil slowly and, after twenty minutes or more, the opening of the spring housing will indicate that rather rapid shrinkage is taking place in the curing plastic. This screw is again tightened to keep the material under the desired pressure.

The boiling is continued from forty-five minutes to one hour, to complete the polymerization process.

It is preferable to permit the flask to cool for at least ten minutes before chilling in cold water. When thoroughly cooled, the injector and cylinder are removed, the flask is separated and the bolt in the side of the middle section is loosened about one full turn to allow ready removal of the case from the flask. (Fig. 12.)

The investing plaster is carefully removed to avoid breaking the anterior teeth and, after the sprues are uncovered, they are cut through with a carborundum separating disk if the case is an upper denture. If it is a lower, it is easier to make the cuts with a saw.

To our great satisfaction, we have now uncovered a fine appearing denture of dense tough plastic. There will be practically no fin of excess material, and the occlusal surfaces of the teeth will fit back into a previously made plaster index with surprising accuracy. Not only has the shrinkage been brought under control, but also, owing to the fact that the pressure on the plastic in the mold is hydraulic, there will be no teeth checked or out of position, and the occlusion will be just as we had established it on the articulator.

In clear cases, the wax sprues are attached a little lower down so that the sprue channel openings lead to the palate area, which is to be transparent. A piece of block tin, about 24-gage, is placed over each channel opening to prevent the pink material from entering. The case is then packed with pink plastic and a trial closure is made. After the flask has been allowed to rest for about five minutes, the palate portion of the plastic is trimmed away to the extent desired and the pieces of block tin are removed. The palate portion is then packed with clear material, which is allowed to back up into the reservoir during the second trial closure. More clear plastic is added to the reservoir, the injector is attached and the case is cured.

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HOT OR COLD APPLICATIONS? A REVIEW OF THE FUNDAMENTAL LITERATURE

By HARRY D. SPANGENBERG, JR., D.D.S., M.S. in Dent. Surg., Columbus, Ohio

A GENERAL practitioner constantly uses local temperature changes in the treatment of surgical and non-surgical conditions in the mouth and about the face. He believes that these applications will do something definite, as, for example, relieve swelling caused by the removal of teeth, cause an abscess to point or inhibit an abscess from pointing. Whether he uses heat or cold is determined largely by what he was taught in school. In most cases, this is only the personal opinion of the instructor and is not predicated upon facts established either by controlled clinical or experimental procedures.

As far as I am aware, there is no existing review of the fundamental literature on the physiology of tissue reaction to local temperature changes. Because of differences of opinion from a clinical standpoint,[1] it seems desirable to study the literature, to determine which are facts and which are opinions.

The literature concerning the effects of localized external temperature applications on the superficial and deep tissue temperature is limited. Bazett[2] states that because of the high heat capacity of tissue, a small temperature change may cause large amounts of heat to be absorbed. Human tissue can tolerate an external temperature of 45° C. (113° F.) before damage occurs. Low temperatures applied for short periods of time seem well tolerated, yet, if freezing occurs, tissue injury is produced by the crystallization of fluids in it.

From the College of Dentistry, Ohio State University.

Thermocouples were used for the measurement of temperature in man as early as 1835. Bazett and McGlone[3] find that a temperature gradient exists in man, the rectal temperature being the highest, the skin the lowest and the muscle intermediate between these two. The gradient is increased in a cold environment and decreased in a warm environment. Hill[4] found that cooling the wrists resulted in a decrease in body temperature.

Lewis,[5] in a study of the effects of cooling on the superficial temperature of a finger immersed in a water bath at 7° C., found that, upon removal of the finger from the bath, the temperature of the skin not only rose rapidly, but also exceeded, for a period of fifty minutes, the temperature of a control finger. If immersion is continued, the fall in temperature is precipitous. The fall in temperature was not maintained, but oscillated slightly. This oscillation did not have any particular rhythm and varied in the same person when tests were repeated. The phenomenon was also found to occur in the projecting parts of the face and in the toes, but could not be elicited from the skin of the forearm. Arteriovenous anastomosis is not necessary for this reaction.[6]

Taylor[7] studied the effects on superficial and deep temperatures of external applications of croton oil, mustard oil, oil of turpentine, olive oil and vaseline. The tissue at a depth of 15 mm. was raised 0.5 degrees C. when the subcutaneous temperature rose 1.4 degrees C. The rise of temperature was ex-

plained by the interference of cooling by radiation. This observation is confirmed by observations of Sheard, who finds that when cooling is interfered with by the presence of excessively high temperatures or excessive moisture in the air, the temperature, particularly of an extremity, goes up.[8]

Zondek, in 1920,[9] and Löwy and Dorno, in 1925,[10] found that local applications of heat cause a rise in the surface temperature and also, to a less degree, in the deep temperature. With cold applications, the surface temperature dropped sharply.[11] There was also a decrease in the temperature at a depth of from 2 to 3 cm. Temperature change was much less with hot than with cold applications, as the heat tends to be distributed by the blood stream, whereas cold applications reduce the circulation to such an extent that even deep tissue has a temperature little above that of the applied temperature.

Macleod[12, 13] *et al.* describe the changes in the subcutaneous and deep temperatures of a rabbit subjected to localized external applications of heat and cold. They found that if hot applications (46° C.) were applied to the shaved skin over the gluteal region, the skin temperature rose to 41° C., and at a depth of 2 cm., the temperature of the muscle rose to 38° C. When a temperature of 14° C. was applied, the skin temperature dropped to 20° C., and at a depth of 1.5 cm., the temperature dropped 4 degrees. I described external applications of both heat and cold to the anterior femoral group of muscles of a series of rabbits.[14] From these studies, it was concluded that it is possible to alter the subcutaneous and muscular temperatures.

Greater changes in tissue temperature are produced by cold applications than by hot applications. Application of temperatures varying between 43 and 45° C. to both the lateral and the medial side of the anterior femoral group of muscles causes the subcutaneous temperature to rise so that it assumes a temperature approximately 2 degrees less than the applied temperature, and causes the muscular temperature to assume a value 5 degrees less than the applied temperature. Applications of temperatures varying between 1° and 5° C. to both lateral and medial aspects of the anterior femoral group of muscles causes the subcutaneous temperature to drop to a temperature approximately 7.5 degrees higher than the applied temperature, and causes the muscular temperature to assume a value varying between 10 and 20 degrees C. higher than the applied temperature.[14]

When a temperature varying between 43° and 45° C. is applied to the lateral side of the anterior femoral group of muscles and a temperature varying between 1 degree and 5 degrees is applied to the medial side, a definite gradient in the tissue temperature is found to exist. The temperature of the subcutaneous tissue on the lateral side rises to a point approximately 5 degrees less than the applied temperature, and, on the medial side, drops to a value approximately 10 degrees above the applied temperature. The temperature of the muscle assumes a value midway between the subcutaneous temperatures.[14]

Macleod[12, 13] investigated the influence of local applications of heat and cold over the liver and kidney of the rabbit. They concluded that the deep temperatures were not profoundly influenced, and they found a moderate alteration in the brain temperature from local hot and cold applications.

Ledingham[15] found from his *in vitro* studies that the optimum temperature for phagocytosis occurs at normal body temperature. If the temperature decreases, phagocytosis also decreases. Temperature alterations did not seem to affect the action of opsonins. In *in vivo* studies, I found that the temperature did not seem to influence phagocytosis.[14] Murphy

and Sturm[16] believe that if rabbits are exposed to dry heat, the activity of the lymphoid organs is increased, resulting in an increase in the concentration of antibodies.

Parker and Rhoads[17] studied the effects of temperature on the structure of blood *in vitro*. They found that at 10° C., the lymphocytes and monocytes remained unchanged in size, but a change in the size, number and placement of granules took place within the cytoplasm. They found that the leukocytes remain viable for a period of from three to four weeks. This is a considerably greater length of time than that observed by Osgood.[18] He believes that the average life of the neutrophil is 61 hours, of the eosinophil, from 8 to 12 days and of the basophil, from 12 to 15 days.

The literature concerning the effects of hot and cold applications upon the vascular system is extensive. In general, investigators have followed two essentially different methods in studying this problem. The first method is the direct observation of the vessels themselves. The second is indirect, concerning itself with the observations of blood pressure, heat loss and analysis of the oxygen content of the blood.

That heat causes the capillaries to dilate[2, 19, 20] is easily demonstrated by warming a rabbit's ear. The arterioles, capillaries and venules are all seen to dilate, with the result that the ear becomes pink. Cold applications below 25° C. cause two reactions: first, a constriction of the arterioles, capillaries and venules,[2] followed in approximately five minutes by capillary and venule dilatation.[19, 20] The arterioles, however, remain constricted. The vascular reactions to thermal irritation are partly the direct action on the vessel walls themselves,[21] and partly the indirect action mediated by an axone reflex and the production of an h. substance.[22]

The blood pressure in the capillary loops studied by the micro-injection technic was found by Landis[23, 24] to present a definite gradient of pressure through the loops. In the arteriole limb of the capillary loops in the human fingernail bed, the pressure was found to be 32 mm. of mercury; in the middle of the loop, 20 mm., and in the venous limb, 12 mm. Essentially the same gradient of pressure was found to exist in the mesenteries of rats and guinea-pigs.[24] Heat was found to increase the pressure in the arteriole limb of the capillary loop to 60 mm. of mercury and the venous limb to 45 mm. On the other hand, cold caused a drop in the pressure in the arteriole and middle and venous limbs of the loop for a short interval followed by a slight increase in pressure. Krogh,[21, 25] Carrier,[19] Lewis[26] and Florey[27] observe, in this connection, that the dilatation or constriction of the capillaries is a function of the capillaries themselves and they are not passively dilated and constricted by increased and decreased pressure. The dilatation and constriction may be partly due to local axone reflexes of the antidromic type along the fibers of the sensory nerves, which probably give off branches to the capillaries and small arterioles.[21] The existence of this reflex is doubted by Rasmussen.[28]

Capillary tonus is not entirely nervous in origin, but depends to some extent on the character of blood in it. A vessel that has been constricted for some time will relax, thereby admitting new blood, which enables it to regain its former tonus.[21] Freeman[29] observes that blood flow is increased by heat and decreased by cold.

Indirect studies of the capillaries in a region may be made by analyzing the oxygen and carbon dioxide content of the blood of the arteries and veins supplying that region. Such a study was carried out by Goldschmidt and Light,[30] who found that when the arm was immersed in water the temperature of which varied from 40 to 46° C., the oxygen content of the blood obtained

from the anticubital vein approximated that of the blood obtained from the artery. This, they believe, was due to the fact that the arterioles, capillaries, and venules were all dilated, this causing the volume of the blood passing through to exceed by far the volume necessary to supply the needs of the tissue for oxygen. If, however, the temperature of the bath varies between 18 and 39° C., the oxygen content of the venous blood is distinctly lower. The carbon dioxide content is higher. This factor gives the skin a cyanotic tint, especially as the temperature approaches 18° C.[20] This observation, they believe, is caused by a constriction of the arterioles and venules, accompanied by the usual need of the tissue for oxygen. The metabolism of the tissue was not depressed in this temperature range. In baths below 18° C., the oxygen content of the venous blood is increased, with the result that the skin becomes pink,[20] because, although the capillaries are relaxed, the arterioles remain constricted. Further, the tissue cannot use or obtain the oxygen, because of either the depressed metabolism of the part or the inability of the oxyhemoglobin to dissociate at low temperatures. It is for this reason that, in extreme cold, red cheeks or hands may not mean good circulation.[20] Clark[31] observes that arteriovenous anastomoses of the hand and fingers must be taken into consideration in evaluating a study of this kind.

The permeability of the capillaries, the amount of tissue fluid, the content of the tissue fluid and the permeability of the lymphatics and the content of the lymphatics are also affected by changes in temperature.[2, 32, 26, 33] Some of these conditions are bound up with the inflammatory reaction.[34]

Starling,[35] in 1896, postulated a theory of fluid balance in which he states that the amount of filtration and absorption of fluids to and from the tissue spaces is determined by the difference between capillary pressure and the pressure exerted by the colloidal osmotic pressure of the plasma proteins. No experimental evidence has discredited this hypothesis. Indeed, through the years, it has been but slightly modified and strengthened by such evidence.[23, 24, 25, 32] The conditions that modify the hypothesis are the change in the permeability of the capillaries in response to injury,[25, 32, 36, 37, 38] the tissue pressure,[33] the venous pressure,[39] the hydrostatic pressure[40] and changes in colloidal osmotic pressure of the plasma proteins.[36, 39] Heat is an irritant that may increase the capillary permeability and thereby modify the balance.[33, 36, 41]

Hudack and McMaster[37] postulate a gradient of permeability for the vessels of the corium, which is unaltered by active hyperemia caused by heat. Such a gradient is also mentioned by Rous *et al.*,[40, 42, 43] all of whom believe that such a gradient may be dependent on inherent differences in the endothelium. However, if the walls are damaged, the gradient disappears and the permeability of the entire capillary loop approaches that of the venules.[37]

Usually, the capillaries, although freely permeable to crystalloids, are impermeable to the colloids; that is, the proteins of the plasma.[25, 32, 33] However, if the capillaries are injured by heat, they become permeable to their entire contents.[25, 32, 36, 37] The capillary pressure also rises when heat is applied, with the result that the osmotic pressure of the plasma proteins is exceeded through the entire length of the capillary loop. Not only is the filtration of fluids increased on the basis of increased capillary pressure when a thermal irritant is applied,[23, 24] but there is, in addition, an increased permeability of the capillaries to the plasma proteins. These conditions result in a tissue fluid unusually rich in protein,[25, 32, 36] and they explain why edema is caused by heat.[38, 41]

Absorption of the tissue fluid and the

crystalloids it contains takes place *via* the capillaries.[25, 32] If proteins are present, as they are in edema caused by heat, they are not absorbable by the capillaries, but are absorbed by the lymphatics.[25, 32, 36] If the tissue fluid is high in protein content, as it is when capillaries are injured, the protein content of the lymph is high.[25, 32, 36]

Tissue pressure,[27] as well as venous obstruction,[36] appears to be important as regards the amount of fluid absorbed by the lymphatics. Florey[27] tetanized muscles previously injected with carbon, and found that the carbon was readily obtained from the draining lymphatics; whereas if the muscles were untetanized, absorption occurred very slowly.

The lymphatics are usually impermeable to their contents,[44] but the permeability may be altered by thermal irritation.[45] In this case, they may fail in their function of drainage[45] as material within may diffuse out as easily as the fluids without diffuse in.[32, 44]

Although heat and cold influence the physiology of normal tissue, I have shown that it has no effect upon certain aspects of the physiology of tissue already affected by the inflammatory reaction.[14] The reasons for this are obscure, but it does help to explain the discrepancies which exist in the opinions of various clinicians. It is not denied that heat and cold do give relief from pain, whether it be inflammatory or unknown in origin. It seems probable that heat gives relief through its counterirritant effect, and cold, through its refrigerant effect. The relief from pain seems to be the only reason that we should use thermal agents.

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MOUTH LESIONS OF LOCAL AND SYSTEMIC ORIGIN

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I DO not believe that there are such specific disease entities as, for example, diabetic gingivitis or pyorrhea, and pregnancy gingivitis. There are thousands of diabetics who never develop pyorrhea, and a vastly greater number of women who become pregnant without ever having gingivitis.

Local irritants and systemic derangement and disease may so undermine the oral tissue immunity and tone that the ever-present bacteria of the mouth can set up the clinical picture. Many of these lesions look alike, yet their etiology is entirely different, and in order to make our therapeutic measures effective, we must know the cause of the trouble and the course that it will follow.

Before discussing oral lesions proper, I should like to mention two commonly seen affections that are due to normal histologic conditions of the oral mucosa. These are melanin pigmentation and Fordyce's disease. The latter is a fine example of an eponym beclouding a simple anatomic fact.

In the region of the basal layer of the epithelium, there are dendritic cells that in non-pigmented areas can only be shown histologically by means of special stains. (Fig. 1.) These cells are melanoblasts. When active, they form melanin, a pigment that is responsible for the brownish discoloration found normally in the mouths of the darker races.[1] They may, however, be abnormally stimulated into productivity by trauma and in Addison's disease.

Sebaceous glands (Fig. 2) are frequently found in the corium of the mucous membrane of the inside of the cheeks and lips, and in that of the buccal gum near the mucobuccal fold above the maxillary bicuspids. When in exaggerated numbers and close to the epithelium, they give rise to a condition erroneously thought to be pathologic and which has been called Fordyce's disease.[2] (Fig. 3.)

ETIOLOGY

There are exogenous and endogenous causes for most oral lesions.

Exogenous Causes. — Trauma: The oral mucous membrane is subjected to constant trauma, which usually is mild and, during the ordinary course of events, can be withstood without any pathologic disturbance. The shape of our teeth and their contacts prevent food from injuring the gingiva. The epithelium of the mucosa will also, under normal circumstances, withstand the action of mild acids or alkalis and thermal changes.

Malalinement of the teeth, the faulty restoration of lost tooth structure or the non-replacement of lost teeth causes mechanical irritation of the tissues, which may result in a variety of lesions ranging from a mild infection to leukoplakia and even malignancy.

Habit may result in another type of trauma, and one of the commonest traumatizing habits is cheek biting. (Fig. 4.)

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Electrical currents: A number of years ago, Lain,[3] of Oklahoma, established the fact that electrical currents could be generated within the mouth by dissimilar metals, and that a variety of lesions could result from burns caused by these currents. The lesions so produced may vary from a superficial excoriation to an ulcer or a leukoplakia patch. I have seen a markedly leukokeratotic palate return to normal after the removal of a large gold bridge.

Infection: Regardless of what the predisposing cause may be, infection must always be considered an important exogenous factor.

Endogenous Causes. — Avitaminosis: Vitamin A, those of the B complex and vitamin C contribute mostly to the well-being of the oral mucosa.

Vitamin A affects principally the epithelium. A lack of this food component has a keratinizing effect, not only on the surface epithelium, but also, through a metaplastic process, on that of the ducts of the salivary glands.

An avitaminosis A may result in leukokeratotic areas on the oral mucosa. This is occasionally seen in those on strenuous weight-reducing diets.

The ducts of the mucous and salivary glands may become keratinized and blocked, a lack of salivary secretion and lubrication resulting. This causes the mucosa to become dry, cracked and painful and is one of the principal causes of xerostomia.

Those of the vitamin B complex of most interest to us are vitamins B_1, or thiamin hydrochloride, B_2, or riboflavin, and the pellagra preventive factor, or nicotinic acid.

With the exception of a peripheral neuritis, a deficiency in B_1, as far as is known, causes no oral lesions *per se.* However, a deficiency of this vitamin causes a loss of appetite, and the lessened food intake will result in a lack of those essential factors that will directly affect the oral mucosa.

The results of deprivation of riboflavin, described recently by Sebrell and Butler,[4] should be known to all those in-

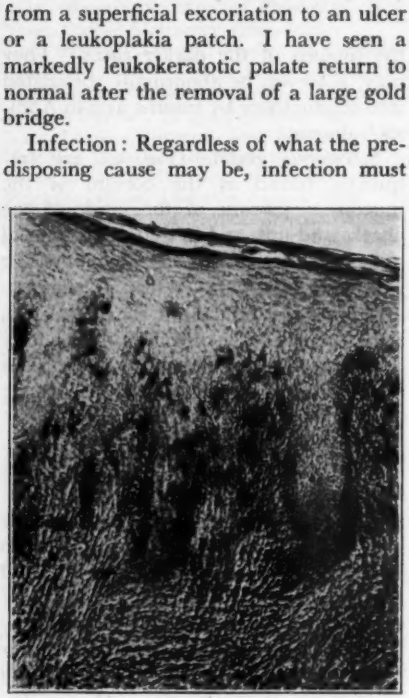

Fig. 1.—Melanoblasts in gum. These were in a non-pigmented area and are brought out by means of the "dopa" reaction.

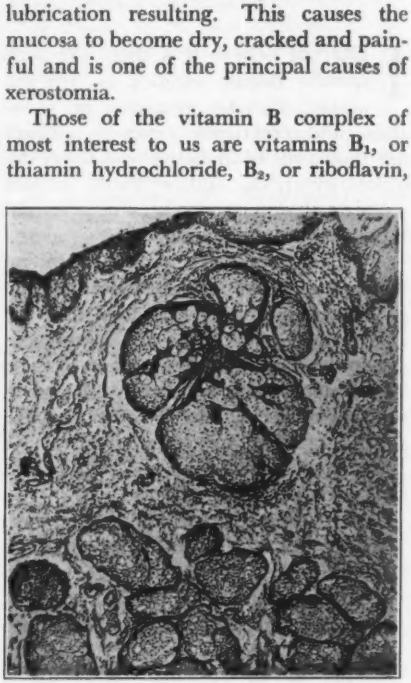

Fig. 2.—Sebaceous glands in submucosa of oral mucous membrane.

terested in the mouth. The lesion, which they called "cheilosis," is described in their own words as follows:

These lesions began as a pallor of the mucosa of the lips in the angles of the mouth without involvement of the buccal mucosa. This pallor was soon followed by maceration, and within a few days superficial transverse fissures appeared, usually bilateral, and exactly in the angle of the mouth. These fissures extended somewhat downward from the angle and there was very little inflammatory reaction. The lesions became moist and covered with a honey-colored crust which could be scraped off without bleeding. In some instances the fissures continued to extend into the skin for a distance as much as one half inch. These lesions resembled those described as perlèche. At about the time the fissures were seen, the lips became abnormally red along the line of closure. This was due apparently to a superficial denudation of the mucosa. In addition to the cheilosis there was also seen a fine scaly, slightly greasy desquamation on a mildly erythematous base in the naso-labial folds, on the alae nasi, in the vestibule of the nose and on the ears.

Fig. 3.—Fordyce's disease. The word "disease" is a misnomer. The condition is simply an affection due to the presence of sebaceous glands and is of common occurrence. The section shown in Figure 2 was taken from this case.

I have observed a number of instances of these fissures at the mouth angles and have seen them involute under adequate dosages of riboflavin. Heretofore, we would have called these lesions perlèche and treated them as infections.

The desquamation, which is also interesting, may give us a clue as to the reason for those cases of true desquamative gingivitis that have up to now resisted all forms of local treatment.

Fig. 4.—Lesion produced by cheek biting.

A deficiency in nicotinic acid causes pellagra. In this disease, gingivitis, stomatitis and glossitis are always present and are usually early symptoms. The tip and margins of the tongue become very red and are frequently swollen. Ulcers may form that are covered with a gray membrane that abounds in the organisms of Vincent. In fact, to the uninitiated, the severe Vincent's infection may well mask the real complaint. Jolliffe has shown a number of severe

cases of Vincent's stomatitis in pellagrins that were cured by the administration of the pellagra preventive factor without the use of any specific antiseptic therapy. King[5] also calls attention to the relationship between Vincent's infection and a deficiency in nicotinic acid. He also found that in four persons with normal gums, the excretion of nicotinic acid in the urine of each was far in excess of that of a patient with Vincent's infection. More investigation along this line is necessary before conclusions can be drawn. King treated four cases of severe Vincent's infection successfully by the oral administration of nicotinic acid.

Fig. 5.—Glossitis caused by excessive use of "oxygenating" mouth washes. It is interesting to note how far this patient can extrude the tongue. This is usually a sign that the patient is constantly viewing it and is apprehensive and probably hypochondriacal. Such a person probably overuses medication of all kinds.

This question of a B complex deficiency in all cases of severe Vincent's infection that have not a blood dyscrasia as their basis must always be borne in mind.

REPORT OF A CASE

In a young woman with a severe ulcerous gingivitis and extremely fetid breath, the teeth looked elongated, the interdental soft tissue was lost and the spaces between the teeth were filled with a foul-smelling débris. Both jaws were affected. The attack was an acute one superimposed upon a chronic one of long standing. The gums were pale and irregularly streaked with the lacy white lines seen in lichen planus. The patient had been treated on a number of occasions for similar attacks of what she termed "trench mouth."

Smears of the gums showed myriads of spirochetes and fusiform bacilli, to the almost total exclusion of other forms of bacteria.

The clinical signs and the smear were typical of Vincent's infection, yet it was evident that this was just a complication. Biopsy of the whitish lined gum showed that these lines represented a mild, but defi-

Fig. 6.—Hypertrophy of gums due to use of dilantin sodium (Kimball). (Courtesy of the Journal of the American Medical Association.)

nite hyperkeratosis—an uncommon finding in the buccal gum.

The woman was a chronic alcoholic. Many alcoholics are markedly deficient in their food intake and suffer from multiple vitamin deficiencies. Many of them are subclinical pellagrins. Blankenhorn and Spies[6] found stomatitis and glossitis in 60 per cent of their alcoholic pellagrins, and the latter observed the rapid cure of these infections with administration of nicotinic acid. In the case under consideration, the Vincent's infection and the keratotic white lines were simply manifestations of a deficiency disease. The reason that the patient had never been

cured of her infection was the fact that the true predisposing causes were not suspected and eliminated.

Vitamin C affects the endothelium of the capillaries and the intercellular cement substance. A lack of this vitamin causes the capillaries to become permeable, allowing interstitial hemorrhage. This accounts for the bleeding and swollen condition of the gums in scurvy. Secondary infection, especially by the fusospirochetal symbiosis, again will result in a lesion that may mask the true condition.

In dealing with the question of avitaminosis, a number of important facts

Fig. 7.—Section of gum showing hypertrophy from use of dilantin sodium. The stroma is very dense and there is a lack of inflammatory exudate.

must be borne in mind. Patients who are deficient in one vitamin are usually deficient in others. The administration of what is thought to be the missing food factor may bring about only the amelioration of part of the clinical picture. Polyvitamin therapy, plus, occasionally, the administration of the extract of whole liver is often indicated.

Avitaminosis may occur in spite of the fact that the patient is receiving an optimum amount of essential foods. This is seen in intestinal disease in which there is interference with the absorption of the foods. Examples of this are found in idiopathic steatorrhea of children and in cancer of the intestines.

An avitaminosis may not have a textbook appearance. There are many of what have been called subclinical cases and these must be appreciated and watched for.

Specific infections: Syphilis and tuberculosis are the two principal specific infections that affect the mouth. So much has been written about the oral manifestations of syphilis that it is unnecessary to go into this question now. Osler said,

Fig. 8.—Smooth "polished" tongue with atrophy of papillae. This type of tongue is seen in pernicious anemia, in the Plummer-Vinson syndrome, in sprue and in other deficiency diseases.

"syphilis is the greatest imitator of disease." One should suspect syphilis as either a cause or a complication in every oral lesion.

Tuberculosis is not always considered in viewing oral disease, yet, in the past two years, I have seen several instances of tuberculous disease of the mouth as a complication of generalized tuberculosis. In none of these cases was the oral lesion

thought to be tuberculous, being treated locally for awhile without avail, until the correct diagnosis was made through biopsy. When oral tuberculosis is a complication of the systemic disease, the prognosis is usually grave and early diagnosis is imperative.

Metabolic disturbances: In hypothyroidism, when myxedema is present, the patients, as a rule, have thick, flabby and bloated tongues against the sides of which are indentations from the teeth. The lips are also greatly thickened. The gums at times become swollen and these patients frequently have difficulty in retaining artificial dentures.

In Addison's disease, the mucous membrance becomes pigmented owing to hyperactivity of the melanoblasts.

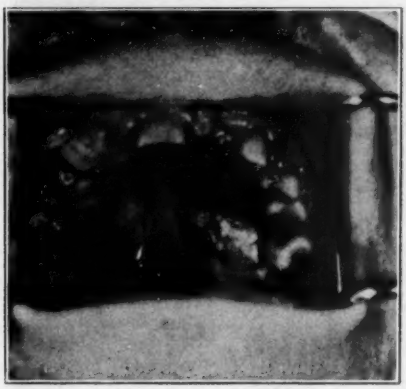

Fig. 9.—Slough that quickly follows any kind of trauma in acute leukemia. In this instance, a tooth had been extracted.

Diabetes is frequently complicated by gingivitis and pyorrhea. This may be due to an increase in the sugar in the gingival and buccal mucosa from the hyperglycemia, which in turn will favor infection by bacteria and fungi, especially yeasts.

In faulty carbohydrate metabolism, there is a greater demand for vitamin B_1. Diabetes may be complicated by this deficiency. This probably accounts for the peripheral neuritis from which diabetics frequently suffer and which is evidenced in the mouth by subgingival hypersensitivity of the teeth (Merritt's sign).[7]

Menstruation: The premenstrual and menstrual periods manifest themselves in the oral cavity. The extremely rare vicarious menstruation from the gums is well known. However, there are a number of less distinctive lesions.

Herpes labialis and buccalis are perhaps the commonest of the oral lesions appearing about this time. They are quite painful and usually attack the same areas each month. To explain the *modus operandi* of these lesions is quite difficult. They are analagous to the acne that occurs regularly in some women. They may be explained on the basis of a lowering of the tissue tone of the oral mucosa so that the herpes virus can become active.

Fig. 10.—Thrombocytopenic purpura. Blood has collected about the necks of the teeth and there are small hematomas present.

Some women regularly develop pericornal infections during the menstrual period. In order to understand why these infections occur at this time, it might

be well to review certain anatomic facts. Posterior to the mandibular third molars, is the loose areolar tissue that contains accessory salivary glands. These glands are structurally similar to the vulvovaginal glands[8] (Bartholin's glands), and also resemble somewhat those of the endometrium. Today, it is established that estrogenic hormones have an effect on the oral mucosa, and there is little doubt that the same hormones act on the accessory salivary glands similarly to the way they do on the vulvovaginal and endometrial ones. Also, in back of the lower third molars, there is nearly always a pocket, or cul-de-sac, especially should the tooth be impacted or malposed, that usually contains many micro-organisms, especially of the fusospirochetal symbiosis. If there is an alteration in the glands from some hormonal stimulus during menstruation, the tissue tone and immunologic defenses become so changed that the bacteria always present in this area can set up the pericoronal infection.

The monthly recurrence of these attacks can be obviated only by removal of the tooth. In one instance, the patient had a monthly swelling of the retromolar tissue quite awhile after the tooth had been removed.

ATROPHIC GINGIVITIS

There is a type of gingivitis characterized by atrophy of large patches of the epithelium. This condition has been called desquamative gingivitis, but it is not a desquamative lesion. Histologically, the epithelium is reduced to one or two thin layers of cells, but microscopically there is no evidence of cellular shedding. Atrophic gingivitis would be a more accurate name. This condition is seen in women chiefly, usually during the menopause or postmenopausal periods. I saw it once in a man. The use of estrogenic hormones locally applied after the manner advocated by Ziskin has given excellent results.

Pregnancy: Pregnancy is frequently accompanied by changes in the gums. This may consist of slight hyperemia and swelling of the interdental papillae, which may be mild and may pass unnoticed. If oral hygiene is maintained, a disturbing gingivitis is rarely seen. However, if the mouth is neglected, so-called "pregnancy gingivitis" occurs. The gums become swollen and congested and the interdental papillae are enlarged and bleed under the slightest provocation.

Another oral complication of pregnancy is a tumor, which may occur in the well-kept mouth, but here again is seen most often in the ill-kept one. Histologically, it is an angiogranuloma and usually disappears after parturition. The reason for the mucous membrane changes during pregnancy are unknown. They may be due to hormone disturbances, vitamin deficiencies due to an increased demand or a combination of the two.

Allergy: Sulzberger[9] defines allergy as follows: "Any acquired specific alteration in the capacity to react, which occurs in living organisms or tissues upon exposure to certain living or inanimate agents or substances."

Aphthae, or canker sores, are familiar manifestations of some sensitivity to foods such as walnuts, cheese and chocolate. Angioneurotic edema of the lips is another example of allergy. These lesions usually represent the hypersensitivity of the tissues to an internal irritant.

We do have mouth lesions that also are caused by actual contact with an irritant. This is a form of dermatitis venenata. For example, there are women who develop cheilitis through the use of lipstick, and other patients who are sensitive to various toothpastes or mouthwashes. (Fig. 5.)

The so-called denture sore mouth may be another example of contact dermatitis. In this instance, we must be sure that the lesion is due to the denture material before making the patient discard the old

for a new denture.[10] I have shown that many of these cases of sore mouth under dentures are due to uncleanliness and that among the organisms recovered, both from the plates and the tissues, was always a yeast of the *Monilia albicans* type. When these dentures were properly cleaned, the lesions beneath them usually healed without changing the denture material.

Loveman[11] reported a case of sore mouth from dentures in which he proved that the stomatitis was due to the oil of anise in the material that was used to clean the plate and not to the plate itself.

The administration of drugs and chemicals: Certain drugs, such as phenolphthalein, quinine and mercury, may cause disturbances within the mouth that vary from eruptions to membranous lesions. These changes are considered an allergic response. On the other hand, contact with bismuth and lead is usually not associated with gingivitis or stomatitis. They merely produce a characteristic line in the gingiva, which is caused by the precipitation into the tissues of the circulating metal in the form of a sulfide. It is to be noted that the bismuth or lead line is seen only in the presence of oral neglect. In the clean, well-kept mouth, this line is usually missing.

Of late, a new drug has been introduced that has a decided effect on the gingival mucosa. It is dilantin sodium,[12] an anticonvulsant used for the alleviation of epileptic seizures.

Kimball[13] was the first to report an undue effect upon the gums. Later, Thoma[14] and others observed similar effects. A marked hypertrophic gingivitis results. (Fig. 6.) The gums are firm, free from pain and do not bleed easily. Kimball thought that there was a vitamin C deficiency as a background, but of late this view has not been accepted. Children and young adults are mostly affected.

Histologically, there is a great increase in collagen. The epithelium does not appear so markedly involved. What inflammation is present is due to concomitant infection. The lesion microscopically is similar to that of diffuse fibromatosis of the gums. (Fig. 7.)

This hypertrophic lesion is a new clinical entity and one that we must suspect in all cases of hypertrophy of the gums, especially if it occurs in young adults or children.

Blood dyscrasias: The terminal oral lesion of acute leukemia, agranulocytosis, severe purpura and pernicious anemia is an ulceromembranous one, clinically similar to a severe Vincent's infection. The early lesions, however, may present different symptoms.

In pernicious anemia, one of the earliest signs is found in the mouth. This is the burning or sore tongue. At times, the discomfort may far exceed any visual reason for its existence. Then may follow the smooth, red, polished appearance of the tongue, with atrophy of the papillae. (Fig. 8.) The gums are quite pale and recurrent aphthae are frequently noted.

In acute leukemia, an early sign is sudden hypertrophy of the gums. It may be mistaken for an acute inflammatory gingivitis or for scurvy. The lesion is due to the deposit of leukemic cells in the tissue. The tissues soon break down, and secondary infection usually results in an ulceromembranous lesion. (Fig. 9.)

Sometimes, an isolated tooth may become painfully loosened and the gum about it swollen and congested. Again, the lesion may be taken for an acute, benign periodontal one. Here once more, an overwhelming deposit of leukemic cells has displaced the normal supporting structures of the tooth.

Chronic leukemia may also have its first symptoms in the mouth. A small localized growth, called an epulis, may appear on the gum, and the pathologist examining the removed specimen will consider it an inflammatory growth. This

variety of lesion, analogous to those of leukemia cutis, may appear months and even years before there are definite peripheral blood changes.

Purpura, either of the thrombocytopenic variety or due to secondary toxic changes, often will affect the mouth. (Fig. 10.) Frequently, there is a continuous oozing from the gingiva, or there may be hemorrhage into the gum tissue. When the latter occurs, the condition may closely resemble acute scurvy, and it may take a number of laboratory tests to distinguish between the two. The structures may soon become necrotic, the condition again resulting in the masking of a Vincent's infection.

In agranulyocytosis, there is a necrotic and membranous gingivitis with a stomatitis. These mouth lesions play an important part in this ofttimes fatal disease and the dentist may be the first consulted. In my experience, women are more often affected than men. Hypersensitivity to drugs, especially the analgesic ones, plays an important part in causation of this condition.

In infectious mononucleosis and in polycythemia vera, the mouth is also involved.

I should like to call attention to one more blood dyscrasia that the dentist may see, a microcytic anemia accompanied by dysphagia and achlorhydria and sometimes known as the Plummer-Vinson syndrome. The patient is usually a woman past middle life and is generally edentulous. She is thin and has atrophic, contracted lips and a very narrow oral opening. The buccal mucosa is usually dull and dry, the tongue smooth and atrophic and occasionally sore. The patient states that she has difficulty in swallowing and has never been able to wear dentures.[15]

Such a condition should be recognized, for the patient is in urgent need of medical attention. Ahlbom[16] and others have shown that such patients are prone to alimentary and pharyngeal cancer. Appropriate treatment will alleviate the condition and will ward off the impending malignant disease.

The sore mouth and the inability to wear dentures are found often in those who have acquired a secondary anemia from whatever cause. It is folly to try to make any prosthetic replacement in these individuals until the anemia has been corrected.

In conclusion, I would say that it is more necessary for us to correctly diagnose the predisposing conditions than it is to treat the local lesions. When this is appreciated, our treatment can be reduced to the following: 1. Stopping pain. 2. Making a correct diagnosis. 3. Reducing infection. 4. Removing the predisposing causes.

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THE STREPTOCOCCUS AND THE CARIOUS LESION

By C. A. SCRIVENER, D.D.S., Ottawa, Kan.

ALL bacterial life depends on a favorable and receptive host. The host or medium inducive of prolific growth in some organisms is unfavorable to the growth of others. This fact is used to advantage in identification of unknown bacteria. In order to develop a desired bacterial culture, a medium containing tissue or other substance known to be inducive of growth of the particular organism should be used and conditions created similar to those in which the organism is known to thrive.[1] In consideration of this belief, the following experiments were conducted.

A number of whole non-carious teeth were extracted, carefully washed and rinsed in distilled water. They were then immediately placed in a humidor and refrigerated.

A large wedgewood mortar and pestle were thoroughly cleaned and chilled. The teeth were placed in the mortar with a little distilled water and were ground to a fine paste. It was hoped in this manner to retain all the elements of the tooth structure without loss due to heat, dehydration and putrefaction.

The paste was washed into a porcelain-lined pan with an excess of distilled water and was boiled for thirty minutes. The broth was then filtered and divided. Twenty per cent refined cane sugar was added to one half the broth and shredded agar-agar of sufficient quantity to produce a thick jelly was added to both solutions. The solutions were then placed in test tubes and closed with cotton plugs. After being heated in the autoclave at 15 pounds pressure for fifteen minutes, half the tubes were prepared to receive "slant" cultures and the remainder to receive "stab" cultures.

A deeply involved carious tooth was extracted, carefully washed and immediately placed in a hydrator and incubated at 98° F. The superficial débris and carious material were removed under strict aseptic conditions to prevent salivary and food contamination, and a sample of carious material was removed from the deep part of the cavity with a sterile spoon excavator. This material was used to inoculate cultures in a series of eight tubes, the prepared tooth-agar medium and several commercial media, including ordinary nutrient agar and Loeffler's blood serum, being used. Both surface and stab plants were made and the tubes incubated at 98° F.

After twelve hours, no evidence of growth appeared except in the two tubes that contained the tooth-agar inoculated by the stab method. In these tubes, a

series of gas bubbles appeared along the line of the stab. Little difference was apparent between the tube that contained the plain tooth-agar and the one to which sugar had been added. After twenty-four hours in the incubator, a definite cloudiness appeared along the line of the stab and more bubbles were apparent. The cloudiness was more dense toward the bottom of the tube, and the bubbles were larger, giving the growth a modified conical appearance.

After six days, the growth appeared more dense, but the gas bubbles became smaller and, in a few more days, disappeared. No visible growth ever appeared in the other inoculated tubes.

This experiment evidently shows the presence in deep carious lesions of an anaerobic organism which is probably a gas producer. Such an organism may be responsible for the gas present in acutely infected root-canals, and the organism may be a definite contributor to the progress of caries.

A culture submitted to a commercial laboratory for identification brought the following report:

> Tube No. 6 shows the presence of a gram-variable coccus arranged in chains, which forms lenticular colonies in proteose No. 3 blood-agar, with partial hemolysis and methemoglobin formation, and is classified as one of the alpha-streptococci (not grouped). The presence of another bacterium was suspected, but on subculture only the streptococci were found.

Further correspondence with the laboratory brought this additional information.

> From your description and our results, we can say pretty definitely that the culture in tube No. 6 was a microaerophilic streptococcus of the alpha group, very *probably Strep. salivarius* (Andrews and Harder). The only *probable* alternative would be *Strep. evolutus,* but, considering the source, the former seems much more probable.

This experiment has been repeated only four times, but results in each case were similar.

In "Dental Caries"[2] several contributors have considered bacteria as a contributing cause of the carious process, most consideration having been given *L. acidophilus.* In a few instances, the presence of a streptococcus was mentioned.

In order to test the solubility of tooth structure in a suspension of this organism, 0.5 gm. of finely powdered tooth structure was added to 2 cc. of distilled water and sterilized in the autoclave for fifteen minutes.

The tube was then inoculated from a culture of the bacteria, sealed and placed on a clockwork device for slight agitation in the incubator. After two or three days, the fluid began to disappear and the tooth structure apparently began to expand and assume the appearance of a colloidal substance. This was surprising, as the amount of solid substance was expected to diminish by dissolution.

After a week, the tooth structure had absorbed most of the water in the tube, and the volume of the solid had increased more than 50 per cent. Could this reaction be responsible for the formation of the well-known "leathery decay" of dentin?

Other tests for the solubility of tooth structure in bacterial suspensions of this organism follow. Six tubes were prepared, three for samples of dentin and three for samples of enamel. Pieces of dentin, each of approximately 20 mg., were carefully weighed and added to each of three tubes containing about 500 volumes of distilled water in proportion to the weight of the sample.

The first tube, containing only dentin and water, was retained as a control tube. The second and third tubes were inoculated from cultures of the streptococcus obtained from deep carious cavities. To the third tube was added 20

per cent saccharose solution. All three tubes were sealed with paraffin.

Three tubes containing enamel samples were prepared according to the same plan, and the entire group was placed in an incubator for two weeks. Each tube was gently agitated once every twenty-four hours. The first twenty-four hours produced considerable activity in the four inoculated tubes, the greater activity appearing in the tubes containing sugar. After forty-eight hours, sufficient gas had developed in the dentin-sugar solution to displace the paraffin stopper and the inoculated tubes all had a turbid appearance. The samples of tooth structure were again weighed after two weeks under as nearly as possible the same conditions as the first weighing. All samples showed approximate loss of weight as follows:

Sugar containing tubes: enamel, 0.809 per cent; dentin, 5.05 per cent.

Inoculated plain tubes: enamel, 0.37 per cent; dentin, 1.0004 per cent.

Control tubes: enamel, 0.57 per cent; dentin, 1.09 per cent.

Contaminating organisms of both rod and staphylococcus characteristics were identified in the resulting solutions, but were found in far smaller numbers than the streptococcus. In order to prevent possible chemical change of the specimen by heat or the sterilizing agent, the tubes and contents were not sterilized previous to inoculation.

Centrifuge tubes containing 100 cc. of distilled water were treated with 0.5 cc. of pulverized whole tooth structure. To one tube, 20 per cent saccharose solution was added, and all were sterilized in the autoclave at 10 pounds pressure for ten minutes. One tube was retained as a control tube, and the sugar solution and third tube were inoculated from the streptococcus culture. All were sealed with paraffin and placed in the incubator.

Each tube was inverted every twenty-four hours and, at the end of two weeks, the volume of each sample of residue had increased as follows: control tube, 33 per cent; sugar-containing inoculated tube, 27 per cent; plain inoculated tube, 26 per cent. Gas formation was evident in both inoculated tubes, and the fact that the volume of the residue increased rather than diminished by dissolution was of extreme interest.

Media were prepared from a series of immune and a series of very susceptible patients by adding agar to their undiluted saliva and sterilizing the mixtures in the autoclave. Sugar was added to one tube of each, and they were all inoculated from cultures of the streptococcus and incubated for seventy-two hours. Twenty per cent of the immune saliva, which had had sugar added, showed slight growth. The remainder of the immune saliva showed no growth. All of the media containing susceptible saliva showed bacterial growth, but the growth was much more prolific in the tubes containing sugar.

Other experiments are in progress concerning the solubility of prepared whole tooth structure in incubated saliva of immune and of susceptible persons and in other bacterial suspensions. More cultures are also being prepared on media containing the saliva of patients both susceptible and immune to caries. The presence of an antibody may determine the extent of growth. Reports of more definite results will follow the conclusion of the series of experiments.

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THE MANDIBULAR ANGLE IN INFANCY: ITS SIGNIFICANCE AND MODIFICATION

By Dorothy I. Stunz, Iowa City, Iowa

THE angle of the jaw in the growing child has been the subject of considerable study. That of the infant has received less attention, and the fallacy that the new-born baby's jaw invariably forms an obtuse angle of around 175 degrees has persisted.[1] Anatomic variability has been overlooked, it apparently being assumed that the angle automatically changes with age, without relation to function or demand. In order to obtain more definite knowledge on this point, the research here presented was undertaken.

In a work of this kind, the extreme difficulty in taking accurate head measurements in the infant necessitates the adoption of the roentgenographic method, whereby in one-twentieth second an exposure can be made that will give a permanent record and one that can be measured and rechecked for accuracy. I am indebted to the radiologic department of the University Hospitals of the State University of Iowa for access to files of roentgenograms of normal infants and to the orthodontic department of the College of Dentistry of the State University of Iowa for access to roentgenograms of older children, which were used to check the relationship between the mandibular angle and malocclusion.

The subjects used in the main part of this study were 325 white infants, male and female, ranging in age from less than 24 hours to 24 months. One hundred and thirty-three of the babies were brought to the Infant Clinic of the Iowa Child Welfare Research Station for physical measurements and were roentgenographed by me, and the remainder were normal babies, born at or brought to the university hospitals and roentgenographed there.

From the Iowa Child Welfare Research Station, State University of Iowa.

TECHNIC

The angle of the jaw was determined by measurements made on a roentgenogram of the head in the lateral position, left side to the film. Two straight lines were drawn, the one bordering the posterior margin of the ramus and the other running along the inferior edge of the mandible to the menton, the two intersecting each other at the gonion and thus forming the angle. The obtuse reading is given in the accompanying table. In the first group, made up of infants under 1 month, there are forty-three cases, twenty-seven male and sixteen female. The average reading for the male cases is 141.6, for the female, 141.2, and for both, 141.5. As there is apparently no outstanding sex difference in this measurement at the age represented here, the cases are submitted, male and female, together.

Secondary landmarks were compared in twenty-seven cases, since difficulties encountered in reading x-ray films sometimes make it desirable (or more convenient) to use these rather than the ones given above. One technic employed the mandibular or sigmoid notch as the landmark for the vertical line, which followed the center of the ramus down to the inferior border of the mandible, where it intersected a horizontal line as above and thus formed the angle. In

the twenty-seven cases, this measurement gave an average reading 4 degrees less obtuse than that obtained by using the posterior border of the ramus. A second technic employed the posterior or outer border of the ramus for the vertical line, but ended the horizontal line at a point directly below the mental foramen instead of at the menton. This measurement gave a reading 2 degrees less obtuse than that given by the measurement employed with the entire group. If these secondary landmarks are used, it is necessary to add 2 or 4 degrees (according to the method chosen) to make the findings comparable to those given in the table.

THE MANDIBULAR ANGLE: AVERAGE READINGS AND RANGE AND GROUPING OF READINGS (UNSMOOTHED)

Cases	Age Months	Readings			
		Average Degrees	Range Degrees	Grouping	
				Per Cent	Degrees
43	0 to 1	141	120 to 164	56	130 to 140
7	1 to 2	138	127 to 153	60	130 to 140
13	2 to 3	136	117 to 148	70	130 to 140
14	3 to 4	134	130 to 140	64	130 to 135
18	4 to 5	132	125 to 150	61	130 to 135
13	5 to 6	130	124 to 135	62	130 to 135
22	6 to 7	130	120 to 137	60	130 to 135
22	7 to 8	130	122 to 135	60	130 to 135
16	8 to 9	130	124 to 140	68	120 to 130
14	9 to 10	128	120 to 138	72	120 to 130
21	10 to 11	128	120 to 141	73	120 to 130
15	11 to 12	130	120 to 142	60	120 to 130
18	12 to 13	128	120 to 142	78	120 to 130
15	13 to 14	130	123 to 138	67	120 to 130
9	14 to 15	129	125 to 134	78	125 to 130
8	15 to 16	130	126 to 134	50	125 to 130
10	16 to 17	128	120 to 136	60	125 to 130
6	17 to 18	130	125 to 138	50	125 to 130
16	18 to 19	130	118 to 142	44	125 to 130
8	19 to 20	130	124 to 135	63	125 to 130
4	20 to 21	128	121 to 130	50	125 to 130
3	21 to 22	129	125 to 135	67	125 to 130
6	22 to 23	129	121 to 133	50	125 to 130
4	23 to 24	126	120 to 130	50	125 to 130

VARIATIONS IN PATTERN

From the accompanying table, it is evident that there is a great deal of variation in the angle of the jaw in infants. This variation is more pronounced in those under 1 month of age than it is in the older age groups. In the first group, the angle ranged from 120 to 164 degrees—a difference of 44 degrees. It will be noted, however, that 56 per cent of the cases fell between 130 to 140 degrees (80 per cent, incidentally, fell between 130 to 150 degrees). There was only one case over 160 degrees.

Variety in development is seen not only in the size of the mandibular angle, but also in the shape of the condyloid and coronoid processes, the depth of the sigmoid notch and the density, as indicated by opaqueness to the x-rays, of the four muscles, the temporal, the masseter, the internal pterygoid and the external

pterygoid, which produce the mandibular movements. At times, the density of these muscles tends to make roentgenographically obscure the true pattern of the ramus. Between the condyle and the somewhat shallow glenoid fossa is the interarticular fibrocartilage meniscus, which also varies a great deal in thickness, and on this depends very largely the degree of flexibility of movement of the lower jaw. In one instance, it permitted the mandible to drop to an almost vertical position.

These variations do not lend themselves to measurement and statistical compilation; therefore, they are illustrated by the accompanying plates (Figs. 1 and 2), which show the two extremes of development encountered in this study. The outer lines for the drawings were traced from the x-ray film, and the detail was filled in by the artist. Both roentgenograms were of children under 1 month of age. These pictures show very clearly the differences in the alinement of the maxilla and the mandible, in the mandibular angle and in the condyloid and coronoid processes, partly obscured by muscles in the one case, and also the variation in the depth of fibrocartilage in the glenoid fossa. The question may be asked as to why the case having the 164 degree angle was not traced instead of the one of 155 degrees. The answer is that the former too closely resembled at the ramus head the well-developed condyle and obscured coronoid process of the infant in Figure 1. This developmental pattern, although usually found in the low-angle group, is not entirely confined to it and appears to be an individual characteristic. The same resemblance was found in the case having the 160 degree angle. Therefore the 155 degree case, the first in the high-angle group to show separation at the glenoid fossa, was chosen.

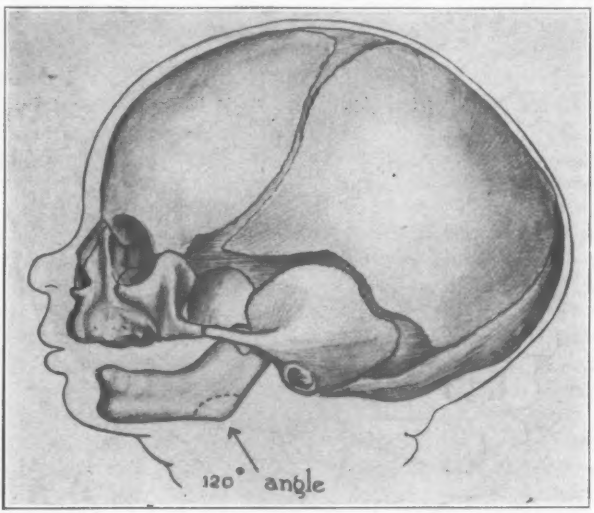

Fig. 1.—Mandibular development (compare Fig. 2).

THE SIGNIFICANCE OF THE MANDIBULAR ANGLE

The mandibular angle becomes significant when we realize that it offers a means of predicting at birth, in a general way, what type of occlusion of the teeth

may later be expected, mesial, distal or neutral. Although it is true that function modifies the mandibular angle, there is no automatic change. In this group of 325 infants under 2 years of age, a selection was made from the x-ray films of those who with four or more teeth erupted maintained occlusion with the lower 5 mm. or more behind the upper, with the lower and upper edge to edge, or with the lower at any distance in front of the upper. This classification showed that those with retarded mandibles had a mandibular angle 8 degrees smaller than the average found for infants of the same age; those who held the teeth edge to edge had an angle 8 degrees larger than the average for their age group, and those with the lower teeth forward had an angle 11 degrees more obtuse than the average for their age group.

Attempts were made to obtain the measurements of the mandibular angles from roentgenograms of older children receiving orthodontic treatment and to check them with the average that I found for this measurement in normal cases of the same age—an average which agrees with the findings of Milo Hellman.[2] (Hellman's figures, however, are arranged according to the seven stages of physical growth marked by tooth accession and not according to chronologic age.) There were insufficient cases obtainable in Class I. Divisions 1 and 2, Class II, because of the latitude in this classification, showed no outstanding differences of the mandibular angle. Cases that belonged to Class III, or at least verged upon it, gave an angle 12 degrees greater than the averages for the age groups in which they fell. This variation appears to indicate clearly, in this group, the relationship between the angle of the jaw and the occlusion of the teeth.

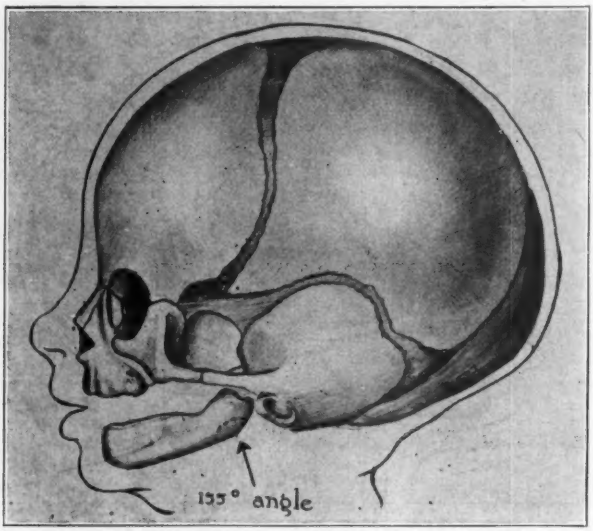

Fig. 2.—Mandibular development (compare Fig. 1).

Joseph A. Pettit and C. H. Walrath,[3] writing on prognathism, make the following statements:

The placement of the teeth, in reference to the alveolar process in which they are set and to each other, may be perfect in a well-

marked prognathism. The relative position, size and direction may harmonize exactly with the upper teeth. The displacement or structural asymmetry is due solely to the fact that the body of the mandible, with the contents of its alveolar ridge, lies in a forward position when the mouth is closed. . . . Anatomically viewed . . . *it represents an obtuse angle* of the mandible rather than an increased length of the body. . . . In prognathism, the chin protrudes usually because of *obtuseness of the mandibular angle* and not of an increased body length.

In like manner, distal occlusion is controlled by the angle rather than by the length of the jaw.

MODIFICATION OF THE MANDIBULAR ANGLE

It has been stated that function modifies the mandibular angle. This is well illustrated by measurements taken at birth and again from a week to ten days later. Only eleven cases were available for this study, but it is significant that the mandibular angle in each one changed with the establishment of the feeding habit, becoming from 2 to 7 degrees less obtuse, whether it was originally average, below average or above average. Similar change through function is demonstrated in the table, which shows the angle of the jaw from birth to 24 months. Here it will be seen that, during the first five months, there is a decrease in the angle of 11 degrees. Most infants make a vigorous new use of the mandible during that time. Excursions of the bite are inaugurated, supplementing the first simple movements necessary for sustenance, and in some cases, there is eruption of teeth. Tooth records were available on thirty-four babies who were from 3 to 5 months of age.* In 38 per cent of these, from one to three teeth had erupted. Three had teeth showing at least 1 mm. above the gum line at 3 months, two at 4 months and eight at 5 months. Since eruption of teeth in the infant is always preceded by a period of excessive biting, the foregoing facts warrant the assumption that, by the time the child is around 5 months, the action of the mandibular muscles and ligaments is established. Again referring to the table on the development of the mandibular angle, it will be seen that, during the following eighteen months, the angle of the infant's jaw remains almost static, changing but 4 degrees in that length of time as against 11 during those first five months of adjustment to the new requirements. Thus may function be shown to modify the angle of the jaw.

NORMAL CASES

If, then, function modifies the development of the mandible, the urgent need of normal muscular movement at once becomes evident. Alexis Carrel[4] reminds us that breast feeding "brings about the optimum development of the jaws . . . ." However, a large proportion of infants, from "10 to 90 per cent," according to their relative income groups, receive artificial feeding. Infant feeding formulae have been the subject of so much scientific investigation that there is no question today that the correct one for the individual child can be obtained. The burden then falls on the mechanics of feeding. Are these adjusted with equal scientific precision? Sometimes the bottle chosen permits the milk to flow so freely that the infant is not required to exercise its jaw sufficiently. Likewise, the method of placing the bottle seldom imitates nature's method very closely. Either for convenience or because picking it up is considered a bad policy, the child is frequently left supine in its bed during the process and the bottle is held in any position rather than a natural one. Often, it is propped on the child's chest as the mother proudly asserts that the baby can now "feed himself." With the bottle at such an angle, what happens to the lower jaw? Obviously, retrusion occurs. Per-

*By courtesy of Amy Daniels' Nutrition Clinic and the Infant Clinic of the Iowa Child Welfare Research Station.

haps too, the great difference of opinion as to the "dire effects" of thumb and finger sucking arises from the fact that the thumb or finger is held at various angles. One child's indulgence in the habit causes irregular development of his jaws. Another comes through a period of similar indulgence with strong, well-alined jaws and with teeth erupting in perfect sequence and position.

ABNORMAL CASES

I have emphasized the fact that correct mandibular movements are necessary in order to retain the jaws in correct alinement until such time as they will be naturally locked in position by the teeth themselves. But what of the infant who does not have normal alinement? Such a case is illustrated by Figure 1. Can anything be done to correct this abnormality? For an answer to this question, we must turn to the work of Robert Dunn,[5] who describes a severe case of micrognathism in an infant of 3 weeks, a condition that he was able to correct by the use of an appliance on the nursing bottle. This appliance, while maintaining its correct position in relation to the maxillae, gradually, "through the efforts in suckling," drew the mandible to its correct forward position. Later pictures of the child show that the lower jaw remained forward and that the alinement of the teeth called for no further correction. This very simple method, supplemented if necessary by the use of a specially designed pacifier, could be used to control both micrognathic and prognathic tendencies, since suckling habits play such an important rôle in developing the mandible and in establishing the movement of the temporomandibular joint, a joint prepared by the fibrocartilage meniscus for adjustment.

DIAGNOSIS

The diagnostic problem remains to be considered. Since it is easier to form a new habit than it is to break an old one, it is desirable that the infant be examined as soon after birth as possible in order to determine the likelihood of normal development of the jaws and to induce corrective habits if an abnormal tendency is disclosed. This examination, as has been stated, can best be accomplished roentgenographically. Hence, while the infant is still in hospital, a lateral x-ray film of the head should be taken. Although a retrusive position of the infant mandible is usually a sign of a condition that will later cause distal occlusion, especially when this retrusion is accompanied by broad, muscle-bound rami, the protrusive position does not necessarily indicate prognathism. It may merely show flexibility in the temporomandibular joint. The most reliable guide, it seems, is to be found in the mandibular angle. Averages in this measurement for each month of the infant's age have been given in the table.

Any deviation from these averages, I believe, calls for observation of the case and advice on correct feeding positions, in order that a slight tendency may not be encouraged to become a malformation. In pronounced cases, the employment of mechanical devices for controlling the development should be considered. The cases of retrusion that are, perhaps, most likely to be brought to the attention of the physician occur in infants who, although there is adequate food supply, refuse to nurse. This is a familiar problem in all maternity hospitals. Although no single cause is responsible for all cases, roentgenographic examination of the mandible is always indicated.

Henry Dietrich[6] ascertained the reasons for weaning 337 infants during the first three months of life. Of these, five refused to nurse, three were not strong enough to nurse, two preferred the bottle, eight were not satisfied, twenty-six made insufficient gains, and sixty-nine could not obtain sufficient milk. Is it not possible that each of these conditions had

its inception in maxillary-mandibular alinement? I should like to call attention once again to Figure 1. Could an infant with this alinement of the maxillae and mandible adequately feed at the breast? In the case of a primapara, in whom the breasts and particularly the nipples are often very small, suction would be almost impossible, and in any case the situation would be difficult. The process of feeding calls for considerable effort on the part of the new-born infant. Muscles have to be strengthened before it can perform this function readily. If the task is too hard, it quickly tires and sleeps. Under those circumstances, the breasts are not drained, and that quickly sets up a vicious circle, for "only regular, thorough emptying of the breasts will maintain a milk supply and . . . any other course quickly leads to bottle feeding."[6]

Cases which are not so pronounced as that in Figure 1, as well as those with a prognathic tendency, are not so readily apparent in the new-born. Here, diagnosis depends entirely upon the roentgenogram.

SUMMARY

Great variety was observed in the development of the lower jaw, more especially in the condyloid and coronoid processes and in the temporomandibular joint. These differences are illustrated in the tracings from the roentgenograms of the two cases in this study group which offered the greatest contrast in development. No instance was found in which the mandibular angle had the obtuse reading of 175 degrees, which it is generally assumed to have in the new-born. In the first group of forty-three, which consisted of infants under 1 month, there was but one case over 160 degrees, and the average for the group was 141 degrees. There appeared to be no outstanding sex differences in this measurement.

Function was seen to modify the mandibular angle. In the eleven cases available in which an x-ray picture had been taken at birth and a second within ten days, the angle had become from 2 to 7 degrees less obtuse with the establishment of the feeding habit. Significant reduction in the angle through function was also seen in the fact that there is a change averaging 11 degrees during the first five months, when the child is learning new excursions of the mandible and is biting vigorously as teeth begin to erupt. After this period, there is little change in the functioning of the jaw, and, in consequence, the angle becomes only 4 degrees more acute during the next nineteen months.

The mandibular angle is here seen as a valuable guide in predicting the type of occlusion of the teeth that may be expected to appear later, and since the temporomandibular joint readily adapts itself at this age to changing functional demands, undesirable incipient tendencies may be overcome before eruption of the teeth complicates corrective measures. Reference is made to Robert Dunn's[5] treatment of acute micrognathism, wherein an appliance on the feeding bottle gradually drew the mandible, through the effort of suckling, to its correct forward position. Inability to feed at the breast may lead to early diagnosis of poor alinement of the maxillae and mandible, and, in any case, calls for definite examination of those parts.

CONCLUSION

It is suggested that the expectant mother be advised to have a lateral roentgenogram of the infant's head taken before leaving the hospital. This should be submitted to her dentist so that any deviation of the mandibular angle from its normal size may be noted, and if corrective measures are indicated, the mother may be advised accordingly. To all who have the care of infants, information should be given which places more definite emphasis on the necessity of maintaining a *normal position* in order

that the infant's lower jaw be neither retruded nor thrust abnormally forward by the effort to obtain nourishment. At the same time, mothers should be instructed to see that the bottle-fed baby is called upon to exercise the mouth and jaws adequately in feeding. Such information would be of special value to those mothers who are financially unable to avail themselves of professional service. In these two ways, through professional service and through the dissemination of practical advice, steps may be taken to lessen the high percentage of malocclusion prevalent today.

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SELECTION OF ANTERIOR TEETH FOR ARTIFICIAL DENTURES

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SUITABLE selection of teeth for artificial dentures depends, first, on an understanding of the principles involved and, second, on the availability of the teeth required. This discussion is concerned mainly with the first part—the principles governing the several factors of selection. Seven main factors are here involved: (1) size, (2) form, (3) brilliance, (4) hue, (5) translucency, (6) distribution of enamel and dentin and (7) asymmetry.

SIZE

We have been somewhat vaguely aware of the fact that large teeth grow in large heads and attempts have been made to correlate their size although anthropometric data to substantiate the correlations are rather scarce.

It is known that gross disharmonies in size of face and teeth have displeasing effects, and for this reason it is desirable to have some dependable criteria for the selection of tooth sizes in artificial replacements.

The services of a well-known anthropologist, Prof. Bruno Oetteking, curator of physical anthropology of the Museum of the American Indian, Heye Foundation, were enlisted in an effort to discover correlations between the breadth of anterior teeth and certain other dimensions such as cranial length, cranial breadth, horizontal circumference and bizygomatic breadth. From a large number of tabulated measurements on unselected skulls, it appears that the average breadth of the upper six anterior teeth amounts to about 45 mm., the average cranial circumference to about 500 mm. and the average bizygomatic breadth to about 130 mm. These meas-

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urements were made on dry specimens, all of them of adult-mature age. The ratio used on living subjects will be given presently.

While, from the esthetic standpoint, the size of a tooth is governed by both the length and the breadth of the crown portion, the suitable length for artificial anterior teeth is determined by quite a number of conditions aside from head size, and so the tooth length will be omitted from the present discussion. Tooth breadth, on the other hand, bears a much closer relation to certain horizontal cranial dimensions.

Upper central incisors, and more especially upper lateral incisors, show a wide variation with reference to all of the cranial dimensions investigated, but when we disregard the individual tooth breadth and consider only the average breadths of the incisors and cuspids, we find greater constancy in their relation to bizygomatic breadth and cranial circumference. Another fact that the investigation brought out is that although the anterior teeth in female crania were found to be actually narrower than those in the male crania, they are proportionately broader when related to the cranial dimensions. This difference is hardly great enough to require consideration in devising a formula of individual artificial tooth selection according to sex, but it is a fact which should be noted in passing.

As already pointed out, the two dimensions that are correlated with the combined breadth of the incisors and cuspids are the cranial circumference and the bizygomatic breadth. In the case of a patient who is to be fitted with artificial teeth, the greatest horizontal circumference of the head measured at the glabella and maximum occipital point will, when divided by 13, indicate an appropriate average breadth of the combined upper six anterior teeth. The chief difficulty in cephalometric determination is the great variation in amount and placement of hair, especially among women. The horizontal circumference may therefore be actually measured in some cases and merely estimated in others. A little practice, however, makes this estimation easy, at least to the extent that the operator may note without difficulty any marked deviation from the average. Where the circumference of the patient's head can be measured, it will be found that this measurement divided by the coefficient of 13 will indicate an appropriate breadth for the upper six anterior teeth.

When only the facial breadth is measured, the coefficient of 3.3 is used.

Devices for measuring the greatest facial breadth over the zygomatic arches are well known. Measurement of facial breadth alone is satisfactory for heads of average cephalic index, but the shape of the patient's head is noted. If the breadth is the same, long heads will require somewhat broader teeth than round heads. When both the facial breadth and the circumference of the head are measured, it will be found frequently that dividing them, one by the coefficient 3.3 and the other by that of 13, will give identical quotients. Where the quotients are not identical, a figure half way between the two is accepted as the indicated breadth of the upper six anterior teeth.

Exceptional mouth width might call for modification of tooth breadth, and it will furthermore be remembered that teeth tend to become narrower with age owing to the wear of the proximal enamel.

As might well be expected, it was found that the relation between tooth breadth and any cranial measurement shows certain variations. At the same time, it will be appreciated that whenever teeth are far out of average proportion to head size, their largeness or their smallness is objectionable from the esthetic standpoint. It follows from this that the dentist is safe in selecting a

tooth breadth which corresponds to the average tooth breadth found in heads of the size under consideration, and that any great deviation from this rule is displeasing to the eye. Likewise, it follows that the patient's facial breadth affords a means of suitable tooth breadth selection, especially when the size thus selected is modified by the circumference of the patient's head when modification is indicated by unusual length-breadth head proportions.

Next we come to a proportion which is one of the most exact to be found in the human body: that of the lower six anterior teeth to the upper six. In all racial groups studied and in both sexes, the breadth relation of the lower to the upper six anterior teeth is 4 to 5. This is a proportion for us to observe in selecting anterior teeth.

Although the combined breadth of the upper and lower six anterior teeth can be related satisfactorily to the circumference of the head and to the facial breadth, the relation of the tooth breadths to one another shows wider variation.

To find the suitable breadth of each anterior tooth, by using the facial breadth of the patient as a basis of proportion, the following coefficients will be helpful:

Upper central incisor, divide the facial breadth by 18
Upper lateral incisor, divide by 22
Upper cuspid, divide by 19
Lower central incisor, divide by 29
Lower lateral incisor, divide by 26
Lower cuspid, divide by 21.

Variations in these tooth proportions are sometimes advisable in order to copy certain effects found in nature. It will be seen, for example, that when narrower lateral incisors are substituted for those of average breadth, it is necessary to increase the breadth of other teeth in order to preserve the over-all breadth of the six. This phase has been dealt with elsewhere.

FORM

Efforts have been made to classify human teeth according to form. Such systematizing is quite possible, but any classification which includes the distinguishing factors, such as outline form, horizontal contours, vertical contours and surface markings, with all of their combinations, becomes too unwieldy to be of practical value in the field of artificial tooth selection. Add to this the complications wherein tooth-to-tooth differences occur in a single set as found in nature, and the possibilities become astronomic.

Human faces too have been classified as to form with a fair degree of success in spite of the combinations and in spite of the fact that the classified forms merge imperceptibly into one another. However, when we attempt to link any of the tooth form classifications to any of the face forms, we encounter real difficulty, in which geometry and mathematics lend the appearance of sophistication, but fail to provide the key. The crux of the question is what scheme Nature follows in harmonizing tooth forms with face forms, because such a scheme, if discovered, would indicate just the forms of teeth to be placed in any given face form. The answer is that Nature places all conceivable forms of teeth in all kinds of faces. On this account, we see no sure way of telling from an examination of the edentulous patient the form specifications of the lost teeth.

Let us not jump to the conclusion that it makes no difference what forms we use. The valid conclusion is merely that, in any specific case, the tooth form required for the face cannot be inferred from what we know today of Nature's scheme. On the other hand, we are not without dependable guides, even though these guides do not rely on geometry or mathematics.

Perhaps we can set down three simple rules by means of which we can safely

select tooth forms that will be appropriate for our edentulous patients. In applying these rules, it will be granted, first, that the selection thereby arrived at may or may not indicate the natural tooth forms which were once present in the patient's mouth, and, second, that the forms thus selected are not the only ones which would be appropriate. These two facts in no way invalidate the rules for selection, because these rules are designed to hold us within the bounds of probability and appropriateness without restricting our choice within these bounds. The results are somewhat like hitting the bull's-eye of a target without respect to the exact spot on the bull's-eye.

Here are the rules:

1. Avoid all extremes. The application of this rule will necessitate the discarding from our mold guides of all samples which are extreme or exceptional in any particular. Molds that are too decidedly square or triangular or flat or rippled or which in any other way depart from the ordinary and thereby attract attention to such peculiarities are to be excluded from consideration.

2. Discard all molds which in and of themselves, irrespective of face form, are not both pleasing in contour and typically human. This rule is not the same as No. 1, although the two are related, and the observance of one will often assure conformity to the other.

3. Eliminate or suitably alter the molds that present the appearance of newly erupted teeth. All four of the labial outlines (incisal, mesial, distal and gingival) change with the advancing years, and the appropriate age characteristics are necessary to naturalness of appearance.

Mold guides restricted by these three rules may require the use of samples from more than one manufacturer, but this is no serious drawback. A basic mold guide containing all of the required graded sizes and at least one pleasing and conservative mold in each size might well be put together in accordance with the three rules suggested. Additions could be made as other desirable molds become available. For each size as determined by the measurements already suggested, a guide of sample teeth assembled according to this plan would afford a simple and safe means of tooth mold selection.

BRILLIANCE

Brilliance or degree of whiteness is fairly constant in the various human races, but diminishes gradually with the passing of time. In the Caucasian race, we are accustomed to seeing a fairly constant tooth brilliance as related to the brilliance of the skin. Whenever this tooth brilliance is much greater or much less than usual, the observer is conscious of an unusual condition. This is not to say that there is a relation here between teeth and skin which produces greater beauty than others, but rather that the tooth brilliance must be held within the limits found generally in nature in order not to assert itself visually. The rule, therefore, is to select a tooth brilliance which does not attract attention to the teeth either because they are too bright or not bright enough. The test is made not by looking directly at the teeth, but by focusing attention upon the patient's cheek or upon some other point of the patient's face far enough removed so that the teeth lie well outside the center of vision.

HUE

The hue band represented by human teeth lies near the center of the visible spectrum and, compared to the entire range of visible wave lengths, the band of wave lengths for human teeth is fortunately narrow. This means that the basic hue of teeth is yellow, with only slight deviation toward red on one side and toward blue on the other. What we term a red tooth is basically yellow,

with a small number of vibrations on the red side, and what we term blue is yellow with a small number of vibrations on the blue side. As with the factors previously mentioned, here too our selections are safe when we guard against extremes. As a matter of practical consideration and for the same reason that we eliminate the extreme forms, so also in the matter of hue we exclude extreme red and blue hues so that our hue range will be slightly narrower than that found in nature.

Our hue guide may well contain three distinguishable hues all close together. On one side would be a yellow tooth containing a slight addition of blue. On the other side would be a yellow tooth containing a slight addition of red. Both of these samples would be for complexions which deviate noticeably from the average. The middle hue, or yellow, will then satisfy the requirements of the largest number of cases and is the one to be selected in all cases of doubt. For definitely florid faces, we select the red variation, and for sallow complexions, the blue one. The rule is so simple that a test in the patient's mouth is hardly necessary, but the test consists in looking directly at the sample held in its position in the patient's mouth. If the yellow sample appears somewhat blue in this test, a red variation is selected, and if it appears red, a blue one is indicated.

Saturation, or the amount of a given hue, is an important factor in tooth color, but it is not an independent factor with which the dentist should have to concern himself in the selection of artificial teeth because the appropriate degree of saturation should be incorporated in the various teeth by the manufacturer. When this is done, saturation as such ceases to be a factor in selection.

TRANSLUCENCY

Natural teeth vary in translucency from patient to patient and also from tooth to tooth in the same mouth. The tooth-to-tooth variation will be discussed under "Distribution," but a few observations might well be made on the subject of translucency itself. Again, it is worth emphasizing that the safe course is to avoid extremes. Most of the artificial teeth used in the past have been too opaque, but, more recently, teeth have been manufactured with too extreme translucency.

Differences in brilliance and hue are less discernible or at least less conspicuous with translucent than with opaque teeth. Apparently, it is because the more translucent teeth take on more of the character of their surroundings. This is an advantage from the standpoint of artificial tooth selection because there is not the same need for exactness of brilliance and hue. It means that fewer gradations are needed to satisfy the requirements of appropriateness. It means, further, that considerable variation from tooth to tooth is possible in both brilliance and hue without these desirable variations calling attention to themselves. In fact, such wide variations as are sometimes found in nature give pleasing effects only when the translucency is sufficient to mask the contrasts.

In connection with this quality of taking on the characteristics of the surroundings, a word should be said about fluorescence because confusion has arisen on this point. Webster tells us that the meaning of fluorescence is "that property which some bodies have of emitting light while exposed to certain rays." In further explanation, he says: "The light of fluorescence is distinct from that reflected . . . and also from that transmitted by the body." It is quite clear, therefore, that the effect of blending with the environment is obtainable through translucency. Sometimes, in the absence of ordinary light, fluorescence is detectable in natural and artificial teeth as well as in rubber bands and lump

sugar, but it is difficult to see any practical significance in this as applied to the subject of artificial teeth. It is the ordinary light reflected and transmitted by the tooth which has the desired visual effect.

DISTRIBUTION

Because natural teeth have not the same color throughout, it is important that we select artificial ones which possess the desired distribution of characteristic areas according to Nature's pattern. Brilliance, hue and translucency vary in different parts of the natural tooth and in different teeth of the same set. Similar variations in artificial tooth selections will do much toward the desired visual effect. In fact, without these variations, it is difficult and sometimes impossible to attain a natural appearance.

The key to natural distribution of brilliance, hue and translucency is the anatomic structure of the natural tooth. The body of the tooth, the dentin, is a mass of ivory-colored material of slight translucency. The enamel covering is laid down as a material of much greater translucency, but practically devoid of hue. These two materials afford a great difference in visual effect, almost entirely because of different distribution of translucency.

Let us consider first the upper central incisor. Horizontally across the incisal border of the unworn tooth, there appears to be a band of gray, because here the enamel is unbacked by the ivory-colored dentin. As the incisal edge is worn away, it is this translucent portion which is removed, so that in well-worn teeth, such as are indicated for many full denture restorations, the so-called "transparent tip" found in some of the artificial teeth on the market is contraindicated.

Vertically along the proximal borders, there appear in natural teeth bands of gray, because here too the enamel is unbacked by dentin. These proximal bands of transparent material are of greater importance than the incisal bands, for although proximal wear continues, it is not so great in extent as is the incisal wear, and seldom is it extensive enough to alter the vertical borders greatly. We should try to select artificial teeth that show the characteristic proximal borders of less hue and greater translucency. The presence of a somewhat too wide horizontal enamel band is not necessarily a serious defect for the reason that it can be ground away as should be done with most of the so-called transparent teeth thus far available. Incisal translucency may or may not be desired, but proximal translucency always is.

Along the gingival border, as well as in the central area of a tooth, the enamel covering is backed by dentin so that the enamel color shows through. This is, of course, the area which gives the tooth its characteristic hue.

The natural upper lateral incisor has a larger proportion of enamel and the enamel extends farther gingivally than on the central incisor, so that, at times, we see a set of teeth in which the horizontal enamel band has been worn away completely on the central incisor, but there remains some of the band on the lateral.

The vertical bands are also proportionately wider, so that the lateral incisor by contrast appears gray.

The upper cuspid has the greatest bulk of ivory-colored dentin and the thinnest covering of enamel, and therefore it is said to be the yellowest of all upper teeth. The gray or translucent incisal portion is less than on the upper incisors and, in worn teeth, it has often disappeared completely.

Although we are discussing the incisors and cuspids, it is worth pointing out, in passing, that the natural first upper bicuspid presents a distribution of dentin and enamel closely resembling that of

the upper lateral incisor and does not resemble the cuspid in this respect, as is so frequently seen in artificial dentures. It is the grayness of the lateral incisor and the first bicuspid which, in the intervening cuspid, gives the yellowish effect so noticeable in natural cuspids.

The lower incisors have proportionately more enamel than the upper ones and, for this reason, they appear less yellow and more gray than their antagonists. The lower cuspid again appears quite yellow by contrast. All of these characteristic distributions in single teeth and in rows of teeth should be present in the teeth selected for artificial dentures.

ASYMMETRY

Symmetry in worn natural teeth is so unusual that we should avoid it in artificial restorations. Asymmetry occurs in size, form, color and arrangement, color in this instance including brilliance, hue and translucency. Although most asymmetry occurs in nearly all sets of teeth in the mouths of middle aged and elderly persons, there is danger of making the contrast too obvious, which may be worse than having no contrast at all. It is best to introduce only slight asymmetry in all four factors: size, form, color and arrangement; size, form and color having the most direct bearing on the problem of artificial tooth selection.

Since the random introduction of contrast and asymmetry may have undesired effects, it is well to consider certain aspects of the tooth assemblage. For example, if the teeth to be used are fairly even of surface, the placing of a tooth with rippled surface in the composition would be incongruous. Likewise, the mixing of teeth which lean toward the spherical form with those more cuboidal would produce disparity.

In the introduction of asymmetry, we must guard against disturbing the horizontal balance of the composition. For example, if the teeth of the right side have greater visual attraction than those of the left side because they are larger or of more vivid hue or of greater brilliance, or on any other account, the impression of imbalance disturbs the observer.

One of the characteristics of natural sets of teeth is that they present different color effects in different lights and from different points of view. This effect is largely due to their grouping or arrangement. Although arrangement itself is not a part of the present discussion, it will be appreciated that teeth should be selected in accordance with their proposed settings. It is known, for example, that more brilliant objects appear larger than darker ones of the same size. When, therefore, it is intended to depress a tooth in a row, the degrees of depression will be related to its brilliance. For instance, if an upper lateral incisor is to be set lingually as compared with its adjacent central incisor and cuspid, its brilliance can safely be increased more than if it were not depressed. With the light source from the front, the increased brilliance would be more evident than with the light source from the side, when shadows would be cast on this tooth. Under certain lighting conditions, the lateral incisor would appear lighter, in other lighting conditions, darker, this giving the subtle changing effects to be desired. Of course, if the lateral incisor is to be set more prominently than the central incisor and cuspid, it might well be slightly darker in order to assure similar adjustment in visual effect.

The same principle is observed in the matter of size as related to position. If, for example, an incisor is to be placed more prominently than its mate, it may be selected slightly smaller, but should not be larger. The general rule, therefore, is to make the asymmetry multiple, but slight, and to preserve the right-and-left balance so that one side

will not attract the eye more than the other.

NORM

Now from all of the foregoing considerations, it is clear that satisfactory artificial tooth selection depends in large part on eliminating from mold guides all teeth presenting extremes in form, brilliance, hue, translucency and dentin-enamel distribution, leaving only the one factor of size wherein any great latitude is permissible. This leads logically to the conclusion that a mean or norm can be of practical value in selecting teeth for full artificial dentures. In accordance with tests made on a large number of patients, a sample assemblage representing the norm was reached. Its upper teeth have the following breadths: central incisor, 7.7 mm.; lateral incisor, 6.2 mm.; cuspid, 7.2 mm.

The lower tooth widths are as follows: central incisor, 5.0 mm.; lateral incisor, 5.4 mm.; cuspid, 6.2 mm.

The color is 3 Y on the new verichrome guide and the mold formula is $^{M42}_{c}$.

This formula indicates medium length with a coronal index of 85 exclusive of the collar.

It will be noted that this over-all breadth of the six upper anterior teeth is 3 mm. less than the average, but the average of 45 mm. appears larger in the average middle-aged person until the proximal sides have been flattened to simulate wear. Therefore, if a single sample assemblage is to be made up for testing in the mouth, this assemblage may well be unground teeth of 42 mm. over-all breadth for the six upper anterior teeth or 45 mm. breadth with worn proximal contact surfaces.

It will be noted further that this norm is all of the same color number, which is satisfactory for testing in the mouth. Wherever the Y-3 color in the sample assemblage is decided to be of the correct brilliance, one Y-2 and one Y-4 can be substituted, for example, without altering the general brilliance effect.

With a single sample assemblage made up for trial in the patient's mouth, according to this scheme, it is comparatively easy to arrive at a suitable selection by merely noting what change, if any, would improve the composition. The norm represented by the sample assemblage thus becomes a fixed point of reference from which deviations can be easily introduced to arrive at the desired effect. The norm here described is not an arbitrary one: it is the result of many trials. On the other hand, there is nothing magic or sacred about it, and each operator may well devise his own norm or may even make up a number of sample assemblages if they would serve him better. It will be found, however, that any great deviation from the mean will have effects which to the observer may appear quaint, which attract attention on account of their nonconformity and which, therefore, are to be avoided.

The procedure of judging all teeth and tooth compositions according to the seven factors here enumerated and the use of a sample assemblage near the mean in all of the seven makes the satisfactory selection of anterior teeth for artificial dentures both easy and certain.

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ENDEMIC FLUOROSIS IN THE KENHARDT AND GORDONIA DISTRICTS, CAPE PROVINCE, SOUTH AFRICA

By T. Ockerse,* Pretoria, S. A.

MUCH has been written lately about endemic fluorosis in other parts of the world, especially in America, Denmark, India, Italy and France, but very little in South Africa, where large areas are affected and where the fluorine content in the water ranges from a trace to as high as 18 parts per million.

Maughan-Brown reported mottled teeth in Kenhardt in 1935.[1] Steyn reports that fluorine has been found in the underground water in South Africa, especially in the North-Western Cape Province.[2] Staz mentions the occurrence of mottled enamel in the Transvaal, Cape and Orange Free State Provinces.[3]

I have accumulated much information and many data about the occurrence of mottled enamel from various surveys and I intend to report fully in the near future on the distribution of mottled enamel in South Africa. It has been observed in the North Western, Western and Karoo areas of the Cape Province, Western and Central Free State and Northern, Eastern and Western areas of the Transvaal Province.

In view of the findings of Dean[4] of the relationship between dental fluorosis and dental caries in several Illinois cities, this article may be of interest. As a result of a report on the occurrence and the nature of poisonous waters in the North-Western Cape Province, the problem was investigated from a public dental health point of view in January 1939.

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METHOD OF SURVEY

School children were examined with probe and mirror in schools in Upington, Keimoes, Kakamas, Kenhardt and Pofadder.

All particulars about mottling and caries and the farms on which children with mottled enamel were born and lived up to the age of 8 were taken down. From this information, areas which seemed most affected were selected and visited. Information about diet and the geologic formations in wells and boreholes was also recorded.

GEOGRAPHY

The Kenhardt and Gordonia districts in which the above-mentioned schools are located are in the North-Western Cape Province between latitudes 27° and 30° south and longitudes 19° and 22° east, 2,500 feet above sea level.

CLIMATOLOGY

The climate is hot and dry. The average annual rainfall is between 5 and 10 inches. The average number of hours of sunshine per day throughout the year is 9.9.

TOPOGRAPHY

The country is flat and forms part of the Bushmanland and Upper Karoo plateau regions.

VEGETATION

The country is mostly covered with shrubs, bushes and succulents, the most prevalent being *Rhigozum tricholomum*, or "driedoring," justicia, *Pentzia virgate, P. incaria, P. globosa,* salsola, *Tribulus zeyheri, Tribulus pterophorus, Tribulus cristalus, Tribulus terrestris, Scenecia longifolius, Acacia giraffae, Boschia albitrunca* and *Aloe dichotoma.*

GEOLOGY

The general geologic formation of the districts is old granites and gneisses. The southern part of the Kenhardt district is in the Dwyka series of the Karoo System. In some areas, the older rocks are covered by a recent calcareous conglomerate. The possible sources of fluorine in the older rocks could be: (1) fluorspar (CaF_2); (2) fluorapatite ($3Ca_3(PO_4)_2 CaF_2$); (3) tourmalin, or (4) various micas.

The fluorine content in the calcareous conglomerate is ± 0.05 per cent and it is found in the lime and the pebbles of granite. The geologic formations of many other areas in South Africa associated with mottled enamel are mostly granites and gneisses.

The geology of areas affected by endemic fluorosis in Nellore, India[5] is granitic gneisses. The fluorine in the water varies from 0 to 10 parts per million.

The water of Colorado Springs, where mottled enamel was first observed and described by McKay[6] and Black,[7] in 1916, comes in contact with granite formations.

SOILS

About 20 miles south and southwest of Kenhardt, toward Verneukpan and Brandvlei, the soils, derived from the Dwyka Series, are very shallow, being about 12 inches thick. They consist of a desert pavement about 2 inches thick overlying a light brown gritty and pebbly sandy clay loam, fairly loose. The subsoil is a reddish brown gravelly, loamy calcareous sand, fairly dense and slightly cemented. The chemical composition of the surface and subsoil, respectively, is as follows: silicon dioxide, 72 and 60 per cent; calcium oxide, 1.7 and 14 per cent; magnesium oxide, 2.8 and 4.2 per cent; disodium oxide, 1.6 and 1.2 per cent; potassium dioxide, 1.7 and 1.6 per cent, and phosphorus pentoxide, 0.07 and 0.09 per cent. The pH is 8.2 in the surface horizon.

In this area, shallow low-lying depressions are a prominent feature. In these pans, drab colored silty clays containing some soluble salts are overlying soft to fairly hard calcareous material, which is also fairly well impregnated with salts.

The soils west of Kenhardt, with the Hartebeest River as the eastern boundary, have a thin layer of quartz pebbles

TABLE 1.—ANALYSIS OF DRINKING WATER OF UPINGTON FROM THE ORANGE RIVER

	Parts per Million
Total solids	283.0
Sulfate (SO_4)	71.91
Chloride (Cl)	28.42
Fluorine (F)	0.38
Calcium (Ca)	44.6
Magnesium (Mg)	9.0
Sodium (Na)	62.5
Potassium (K)	16.0
Nitrate (NO_3)	4.2096

TABLE 2.—ANALYSIS OF DRINKING WATER AT KENHARDT

	Parts per Million
Total solids	810.0
Sulfate (SO_4)	107.3
Chloride (Cl)	195.4
Fluorine (F)	6.8
Calcium (Ca)	67.1
Magnesium (Mg)	27.2
Sodium (Na)	138.0
Potassium (K)	21.2
Nitrate (NO_3)	10.32

and gravel on the surface. They consist of a light reddish brown sand, slightly coherent, underlain by a reddish brown gravelly sand, slightly dense, resting on a pebbly, gravelly sand cemented into a slaty hardpan.

In the neighborhood of Pofadder and further north on the left bank of the Orange River, the sandy soils are deeper than those further south. They are derived from granite and gneiss, are grayish or pinkish and contain no free lime, except when influenced by local conditions, but are nevertheless not leached of their bases. The surface is almost flat to gently undulating.

The deeper phase of these soils occurring west of Kakamas has a chemical composition by fusion analysis of about 74 per cent silicon dioxide; 2.5 per cent calcium oxide; 1.4 per cent magnesium oxide; 2.0 per cent sodium dioxide; 3.0 per cent potassium dioxide, and 0.04 per cent phosphorus pentoxide. The pH is 8.7.

North of Kenhardt to Louisvale and Upington and extending into the Kalahari Desert beyond the right bank of the Orange River, the country is slightly more undulating. On the "bults" or ridges, the soils consist of stony calcareous material varying in thickness from 3 to 6 inches. The vegetation is very sparse. In the slight depressions constituting the surface drains, a thin layer of reddish brown sand is resting on a hard lime horizon about 6 inches thick, underlaid by rock granite, gneiss and micaceous schists. In these surface drains, the driedoring shrub grows in abundance and grass springs up whenever it rains.

From 30 to 40 miles north of Upington, the Kalahari sands occur, consisting of reddish brown sand swellings and dunes with little or no change in texture and structure with depth. The troughs between the dunes are more compact. The sandy soils of the dunes have the following chemical analysis: about 0.90 per cent silicon dioxide; 0.70 per cent calcium oxide; 0.35 per cent magnesium oxide; 0.16 per cent sodium dioxide; 0.75 per cent potassium dioxide, and 0.03 per cent phosphorus pentoxide. The pH of the surface layers is about 7.1.

Along the Orange River, deep gray light sandy loam of alluvial origin is found. These soils are fertile, being well supplied with plant foods.

Owing to the very low rainfall in these areas, the soils have not been leached of minerals.

TABLE 3.—ANALYSIS OF DRINKING WATER AT POFADDER

	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6
Total solids	3,310	1,404	746	1,004	860	956
Sulfate (SO_4)	660.5	206.8	74.5	112.7	90.2	141.1
Chloride (Cl)	994	362.1	163.3	248.5	205.9	227.2
Fluorine (F)	2.6	2.4	3.3	2.8	2.6	2.5
Calcium (Ca)	384	148	128	108	108	136
Magnesium (Mg)	68.3	87.8	34.2	48.8	34.2	34.2
Sodium (Na)	443.9	154.1	75.9	133.4	75.9	71.3
Potassium (K)	10.1	12.1	9.0	9.0	10.1	9.0
Nitrate (NO_3)	2.9	Neg.	8.0	32.0	7.1	Neg.
Calcium carbonate per hundred thousand parts of water:	14.4	22.8	18.6	17.4	16.8	16.8

WATER

Water for drinking and domestic purposes is mostly obtained from wells. Some boreholes have been sunk and, according to the foremen of drilling ma-

chines, the strongest waters are encountered in the lime formations. People in Upington, Keimoes, Kakamas and along the Orange River use river water out of furrows. Most of the well waters are highly mineralized and contain large quantities of calcium, magnesium, potassium fluorine, etc. From observation, it seems that the waters from wells and boreholes sunk in the granite formation contain the highest amounts of fluorine.

AGRICULTURE

Sheep farming is the chief agricultural activity in these districts.

DENTAL EXAMINATIONS

All children were examined with probe and mirror and all defects charted. All cases of mottling were classified according to Dean's classification; i.e., (1) questionable, (2) very mild, (3) mild, (4) moderate, (5) moderately severe and (6) severe.

"Children with no caries" must be interpreted as those children who have never suffered from caries. The comparisons are mainly based on the number of children who have always been free from caries. To compare the various degrees of caries per tooth in so many children was impossible in the short time at my disposal.

Children were examined in the following urban schools: (1) Upington Lower School, (2) Upington High School, (3) Kenhardt School and (4) Pofadder School.

Upington is 72 miles north of Kenhardt, which is 120 miles east of Pofadder. In the Upington Lower School (ages 6-15), the number of children examined was 474; number of children with no caries, 124. The incidence of dental caries was 74 per cent. The number of children with mottled enamel was sixty-three; the number of children who were born and grew up in Upington, ninety-seven; the number of children without caries, twenty-one. The incidence of dental caries was 79 per cent. The number of children with mottled enamel was three (roughly 3 per cent).

In Upington High School, the number of children examined was 293 (ages 12-17). The number of children with no caries was ninety-eight. The incidence of dental caries was 67 per cent. The number of children with mottled enamel was fifty-five. There were twenty cases of very mild mottling; seven of mild mottling; twenty-one, moderate mottling; four, moderately severe mottling, and three, severe mottling.

Nearly all of the children with mottled enamel were born in the Kenhardt and Gordonia districts and did not drink the water from the Orange River until coming to school in Upington.

The results of an analysis of the drinking water of Upington from the Orange River is shown in Table 1.

There were 14.92 parts of calcium carbonate per hundred thousand parts of water.

In the Kenhardt School (ages 6-16),

TABLE 4.—INCIDENCE OF CARIES, ETC., IN UPINGTON, KENHARDT AND POFADDER

Place	Number Children Examined	Number Children No Caries	Number Children Mottled Enamel	Incidence of Dental Caries Per Cent	Amount of Fluorine in Water*
Upington	767	222	118	76	0.38
Kenhardt	318	235	262	26	6.8
Pofadder	183	151	171	17	2.46 (Av.)

*Parts per million.

the number of children examined was 318; the number of children with no caries, 235.

The incidence of dental caries was 26 per cent. The number of children with mottled enamel was 262. The number of children who were born and grew up in Kenhardt was thirty-eight. The number of children with no caries was twenty-nine.

The incidence of dental caries was 24 per cent. The number of children with mottled enamel was thirty-eight, four cases being classified as very mild, five mild, seventeen moderate, seven moderately severe and five severe.

Nearly all the other children with mottled enamel were born in the Kenhardt district. Of the 142 children with mottled enamel born in the Kenhardt district, nine had questionable mottling, thirty-three very mild, forty-three mild, forty-six moderate, eight moderately severe and three severe.

Results of the analysis of the drinking water at Kenhardt are given in Table 2.

There were 27.36 parts of calcium carbonate per hundred thousand parts of water.

The fluorine content of four well waters taken around Kenhardt in the district averaged 7.7 parts per million.

In the Pofadder School (ages 6-16), the number of children examined was 183; number of children with no caries, 151; incidence of dental caries, 17 per cent; number of children with mottled enamel, 172.

Of the eleven children with no mottling, the majority came from other districts, and it can safely be stated that the mottling is 100 per cent. In the 172 children with mottled enamel, there were nine cases of questionable mottling; thirty-one, very mild mottling; thirty-five, mild mottling; eighty-three, moderate mottling; six, moderately severe mottling, and eight, severe mottling.

The results of the analysis of six samples of drinking water taken from boreholes in Pofadder are shown in Table 3.

TABLE 5.—WATER ANALYSIS AT UPINGTON, KENHARDT AND POFADDER

	Upington	Kenhardt	Pofadder (Average)
Sulfate (SO_4)	71.91	107.3	187
Chloride (Cl)	28.42	195.4	324.5
Fluorine (F)	0.38	6.8	2.46
Calcium (Ca)	44.6	67.1	153.1
Magnesium (Mg)	9.0	27.2	48.1
Sodium (Na)	62.5	138.0	137.8
Potassium (K)	16.0	21.2	9.5
Nitrate (NO_3)	4.2096	10.32	11.3
Total solids	283.0	810.0	1238.0
Calcium carbonate per hundred thousand parts of water	14.92 parts	27.36 parts	17.8 parts

MOTTLED ENAMEL IN DECIDUOUS TEETH

Twenty-two cases of mottled enamel in deciduous teeth were observed. The majority showed very mild mottling, only one or two teeth being involved, mostly showing opaque patches.

In one case, in a boy aged 6, all the deciduous teeth had a chalky appearance, with a slight stain infiltration and pitting of all upper and lower deciduous molars. The brother of this patient, aged 7, presented a light chalky appearance of all the deciduous teeth, but no staining or pitting.

In one case, in a boy aged 9, there was a chalky appearance, with pitting of the eight deciduous molars but no staining.

Another case, in a girl aged 7, showed a chalky appearance and pitting of the four second deciduous molars.

DIETARY HISTORY

Valuable and reliable information regarding the diets of the children was given by the sheep inspectors who visit their homes regularly and who are intimately acquainted with their modes of living.

The diet of the majority consists mainly of (a) bread, (b) meat, (c) milk, (d) some eggs and (e) a little fruit in season in Kenhardt and Pofadder, but plenty in Upington.

SUMMARY

The total number of children examined was 1,268; total number with no caries, 608; total with mottled enamel, 551.

CONCLUSIONS

1. The presence of fluorine in the drinking water of certain areas in the Gordonia and Kenhardt districts causes mottling of the teeth ranging from questionable to severe, the degree depending on the amount of fluorine in the water. The mottling is 100 per cent in certain areas in and around Kenhardt and Pofadder. In many cases, it is so severe that it is a predisposing cause of dental caries.

2. The incidence of dental caries among children born in Upington and continuously exposed to the influence of the river water with a fluorine content of 0.38 parts per million is 79 per cent.

The incidence of dental caries among children born in Kenhardt and continuously exposed to the influence of water with a fluorine content of 6.8 parts per million is 24 per cent.

The incidence of dental caries among children born in the Pofadder area and who were continuously exposed to the influence of water with a fluorine content of 2.46 parts per million is 17 per cent.

3. As all the other factors in dental caries appear to be equal, the foregoing marked differences in the percentage incidence of dental caries seem to be due to the composition of the drinking water. Whether the variable amounts of fluorine or any other elements are responsible for this marked difference is a problem which should be studied.

Dr. A. I. Malan and Mr. P. K. van der Merwe of the Onderstepoort Laboratory rendered assistance and cooperated during the investigation. The Geological Survey of the Department of Mines furnished geologic information. Mr. C. R. van der Merwe, of the Division of Chemical Services, Department of Agriculture, furnished information about the soils of the Gordonia and Kenhardt districts.

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USE OF EVIPAL SOLUBLE AS AN INTRAVENOUS ANESTHETIC IN DENTISTRY

By Benjamin Goldberg, B.Sc., M.D., Los Angeles, Calif.

INTRAVENOUS anesthesia has a place in all types of dental surgical procedures. The use of nitrous oxide in many dental offices is gradually being replaced by intravenous anesthesia using some form of barbiturates. For the patient needing a short anesthesia, evipal soluble seems to be the anesthetic of choice.

For intravenous anesthesia, the patient needs no preoperative preparation, and neither does he need any preoperative sedative. After the patient arrives at the dental office, a careful history should be taken and a physical examination made, in order to detect any disease of the heart, lungs, liver or gallbladder. If the history is essentially negative and the patient's physical examination shows the general condition to be within normal limits, one may proceed with the intravenous administration of evipal soluble.

The technic is as follows: The patient is first placed in the dental chair with the back and headrest lowered. The clothing is loosened. If there is removable dental work of any type, it is removed before administration is begun. A rubber prop is placed in the mouth on the side opposite the field of operation. If both sides of the mouth are to be operated upon, the rubber prop is shifted after the anesthetic has taken effect.

The intravenous anesthesia is begun by injecting evipal soluble into the median vein of either arm at the rate of 1 cc. every fifteen seconds. The patients who are not apprehensive are usually asleep within from thirty to forty-five seconds. Usually, between 3 and 4 cc. of the evipal soluble is injected to induce anesthesia. For the average number of dental extractions, it has been found that only from 3 to 4 cc. of evipal soluble is necessary to give complete anesthesia for the duration of the operative procedure. When the patients are overweight or extremely apprehensive, a larger amount of evipal soluble may be needed.

The advantages of evipal soluble anesthesia are manifold. There is virtually no excitement stage. There is usually no cyanosis or other change of color of the patient. The pulse pressure and blood pressure change very little. The pupillary reflexes react throughout the entire anesthesia and the cough reflex is not abolished. This is an important point since it tends to prevent the aspiration of foreign material into the bronchi and lungs, which may result in pneumonia. However, it must be remembered that if there is much free hemorrhage after the extraction, an aspirator should be used to keep the blood from entering the bronchi.

The time that the patient is asleep is usually very short. In the majority of cases, the patient is wide awake as soon as the dentist finishes the extraction. At times, tremors of the extremities have been noted, but to date there have been no serious accidents or any untoward complications of any type. In setting up the equipment in the dental room, however, it is advisable to have a vial of picrotoxin and metrazol and also coramine available for any emergency that might arise. An airway and an oxygen tank might be desirable for ready use.

If it is necessary to keep the patient under anesthesia for a longer period of time for extraction, the fractional dosage method may be used in conjunction with preliminary sedation employing morphine or some barbiturate.

At the time of writing, evipal soluble has been administered intravenously about 100 times for several dentists with excellent results in all cases. The patients' ages and weights varied, the age limits being 15 and 75 and the weights varying from 70 to 240 pounds.

The advantages over gas anesthesia are the following:

1. There is no excitement stage in going under the anesthesia or in waking.
2. There is usually no change of color under anesthesia and the cough reflexes are not abolished.
3. The time of anesthesia can be controlled.
4. Use of the anesthesia has proved safe and the patients have been well satisfied with it.

2030 Wilshire Boulevard.

MYELOGENOUS LEUKEMIA AND ITS INFLUENCE UPON POSTOPERATIVE HEALING

A DENTAL STUDY WITH REPORT OF ONE CASE

By MERVYN FRIEDENBERG, D.D.S., San Francisco, Calif.

THERE seems to be a general feeling that, even when dental infection is present, the necessary tooth extractions and other oral surgical operations should not be performed in patients who are suffering from myelogenous leukemia. The almost universal objection to surgical measures under such circumstances is based upon the danger of incomplete healing and the possibility of dry socket, osteomyelitis and sloughing. There is the additional fear of inability to maintain the clot, uncontrollable hemorrhage, severe anemia and death.

Contrary to this belief, it has been my experience that oral surgical operations can be performed with reasonable safety upon leukemic patients if the proper procedure is followed. I have operated upon three such patients without encountering any of the above-mentioned complications and I am herewith reporting one case in which eleven oral surgical operations of various types were performed and complete healing was obtained.

REPORT OF CASE

A farmer, aged 39, whose illness had just been diagnosed as myelogenous leukemia by William L. Bender, clinical professor of medicine at the University of California, was referred to me in August 1939.

Roentgenograms revealed large faulty fillings, suspicious looking inlays and pyorrheic pockets. Some of the teeth were extruded because of lack of occlusion. At the sites where extractions had been made ten years previously, there was residual infection, with rarefied areas containing necrotic bone. I verified these findings clinically and found the condition even more extensive than the x-rays indicated.

The medical report revealed that although the patient was 6 feet tall, he weighed but 140 pounds and was markedly debilitated, but still able to walk. The spleen was tremendously enlarged and quite tender, the tenderness extending well below the um-

bilicus. In addition, the ankles were swollen and leukemic nodules were present over the knees. The blood picture was characteristic of myelogenous leukemia, the white cell count being 256,000, with a differential of 86 per cent myelocytes, polymorphonuclears 10, lymphocytes 0, monocytes 0, basophils 2 and eosinophils 2. The hemoglobin was only 38 per cent and the red blood cell count 3,200,000, showing a severe anemia. The blood sugar was normal.

As much as the consulting physician desired to have the dental infection eradicated, he hesitated to assume the responsibility of making such a recommendation. He feared that in a patient of this type, surgical measures would invite an uncontrollable hemorrhage, with aggravation of the anemia, and possibly even death. Should the outcome not be quite so unfortunate as that, he still rightly feared the possibility of infection and sloughing with a resultant ulcerated unhealed operative wound.

Nevertheless, after I explained that my previous experience with oral infections in leukemia did not justify such fears, Dr. Bender readily agreed to whatever surgical procedures I thought necessary.

I am firmly convinced that before any operative interference is instituted, careful preparation of the patient is vitally important for a successful outcome.

In this case, I prescribed an iron compound and liver extracts, vitamin C, large amounts of gelatine and copious quantities of water. An aromatic chloramine-T mouthwash was ordered and the patient was directed to secure a new toothbrush.

The purpose of the treatment was to facilitate elimination, increase the resistance, lessen the likelihood of hemorrhage and promote healing.

The tissues about the teeth were swabbed with a 2 per cent solution of chromic acid and the superficial calculus and débris were carefully removed, care being observed not to disturb the gingiva, which might lead to unnecessary bleeding.

Sulfanilamide powder was sprayed into the interproximal spaces of the lower teeth. This was confined on the labial and lingual surfaces by use of a surgical pack and allowed to remain for two days.

On the third day, the packing was taken out and the tissue swabbed with 2 per cent solution of chromic acid. The remaining calculus and débris were then removed.

After the mouth was sprayed, gauze packings were placed to wall off the field of operation. The tissue then was painted with 3.5 per cent iodine. Right and left mandibular injections of procaine were made. The operative area included the lower eight anterior teeth.

Sharp horizontal incisions were made on both the labial and the lingual surfaces of the lower jaw, extending to the bicuspid area. The operation involved an area 35 mm. wide. The gingival tissue above the incision was removed, granulomatous material, which was carefully curetted away, being exposed. All loose or roughened bone was smoothed. Normal bleeding responded to gauze pressure. Sulfanilamide and iodoform powder were then sprayed on the operative areas, after which care was taken to completely cover it with blood. The teeth were joined together with a thin ligature, to maintain their position and to act as an aid in the retention of the surgical pack, which was placed labially and lingually, its use being to promote healing, to prevent the blood clot from breaking down and to avoid contamination from the fluids of the mouth. Bleeding was controlled, the patient's health was in no way impaired and there was no discomfort or pain.

After ten days, the packing was removed. The tissue appeared normal and new granulations were present. Immediate massage was employed to institute drainage, to note coagulability and to prevent development of hypertrophied areas. This procedure was also intended to lessen the possibility of secondary hemorrhage. No complications developed and a healthy physical reaction of the tissues was seen.

The most extensive operation that was performed involved an area 50 mm. in width. This included the extraction of the remaining upper six anterior teeth, and also the elimination of residual necrotic infection, alveolectomy and reduction of an enlarged tuberosity.

Sharp incisions were made horizontally on the crest of the ridge laterally from the

present teeth. The periosteum was carefully retracted so that later it could be placed in its proper position. The field of operation was well exposed to avoid the antral region and lessen the possibility of disturbing it. To facilitate extraction of the teeth, prevent undue trauma and avoid possible breakage of the teeth, a hand chisel was used. Any excess of the labial plate was first removed; the teeth were extracted, and the remaining bone was trimmed with rongeurs.

All spicules were then smoothed over with a bone file. All necrotic material was taken away and smoothed, along with correction of the tuberosity. As previously stated, the involved area was sprayed evenly with sulfanilamide powder and iodoform. Every effort was then made to see that all operative surfaces were covered with blood, to promote healing and prevent the possible occurrence of dry socket or osteomyelitis.

The tissues were handled gently and carefully approximated; all excess blood was expressed, and the wound was sutured. The entire surface was then sponged to note the apposition of the incisions and to reveal any unnecessary bleeding. Conditions being satisfactory, the patient was dismissed, with a warning against the use of postoperative mouthwashes. A glass tube was used for the ingesting of liquids. The patient was seen that evening and also the following day. He experienced no discomfort and was free of pain and without hemorrhage. Some puffiness of the lips had occurred, however, and there was a slight discoloration of the operative surfaces, but these rapidly returned to normal.

I kept the patient under observation for three days, then permitted him to leave, with the warning that he should return immediately if any untoward symptom or condition developed. This warning proved to be unnecessary, for he had no postoperative trouble.

The great amount of work performed in this last operation was against my better judgment. It was done only because the patient lived 600 miles away, and business necessitated his leaving directly.

As this completed all of the necessary work, he was advised not to return until a month later for dentures, to give the tissue a chance to heal.

In all, eleven operations of similar type and extent were successfully performed on this patient without encountering any of the conditions feared in patients with myelogenous leukemia. Teeth were removed, pyorrheic pockets eliminated, residual necrotic areas curetted, enlarged tuberosities reduced and alveolectomies performed

CONCLUSIONS

1. When necessary, it is possible to perform oral operations with safety in patients who are suffering from myelogenous leukemia.

2. The danger of hemorrhage, faulty healing, sloughing and possible aggravation of the disease as a result of dental surgical measures has, in my opinion, been unduly emphasized.

3. It was possible to perform eleven oral operations in the case reported without any of these hazards.

450 Sutter Street.

PROSTHODONTIA'S PRESSING PROBLEM, PROGRESSIVE RESORPTION

By W. H. Savage, D.D.S., Clifton Forge, Va.

THAT we may understand each other, we must speak the same language. The caption "Prosthodontia's Pressing Problem, Progressive Resorption" refers to a condition in the mouth that quite often troubles both patient and dentist. You may term it diffuse alveolar atrophy or continued shrinkage of gum and alveolar border; it matters little, for "it is a condition and not a theory" that confronts us.

The dentist dismisses his patient after inserting well-fitting full upper and lower dentures. Within a few short months, they no longer fit. Obviously, it is the foundation that has changed and not the dentures.

In dental school in 1888, we were taught that time and pressure were the underlying factors involved, and that shrinkage proceeded to a more disastrous extent if no dentures were worn.

It is a far cry from that day to this year of our Lord, yet slowly we have made progress. We have come to recognize the etiologic conditions that may be responsible for this condition, acting singly or collectively, a full quartet. We may, profitably perhaps, examine these chronologically.

In the early 1890's, L. P. Haskell, of Chicago, was considered by the dental world as without a peer in artificial denture work. At the zenith of his fame, he gave it as his opinion that resorption was definitely worse under vulcanite than under metal, owing to faulty thermal conductivity, the retention of heat. He was partial to a swaged gold denture, but his was a master hand and he could construct a denture for the upper jaw that would sustain a downward pull of 15 pounds. This antedated the modern impression technic and the Greene brothers had not introduced the phrases extension for retention, muscle trimming, postdamming and relief without leak.

Today finds vulcanite almost obsolete, having outlived its usefulness. Porous, unhygienic, unsightly, weak, though vulcanized against tin foil, and unpleasant to use, its qualities have caused certain commercial laboratories to discard it entirely. It may be of interest to some to learn that, years ago, an enterprising technician developed a method of gold plating dental rubber. If the plate had been worn and absorbed grease, it required about three days' chemical treatment prior to the gold plating, which was supposed to fill the pores, thereby greatly improving thermal conductivity. The cost was $15, but the scheme proved to be short lived and vain.

Its superior thermal conductivity is one of many reasons that methyl methacrylate (acrylic) resin has supplanted rubber, and it is highly significant that Schlosser, in his recent book, advises the dentist to make dentures himself, since so much drudgery is eliminated in fabricating this material. I cannot refrain from injecting here a bit of my personal technic: I purchase acrylic resin in units of both light and dark pink shades in powder-liquid form. From a complexion standpoint, for the pronounced blond, I use the light pink; for the pronounced brunette, the dark; while that vast army

of in-betweens may be satisfactorily served by the use of two parts of light with one part of dark.

Factor No. 2 has to do with overcompression of the foramina, and there is little question as to its possible effect. Undoubtedly, the wanton disregard of this factor is quite often a cause of continued resorption, for blood vessels and nerves issue forth and relief should be provided against their undue compression, else Nature will take a hand, since nutrition is interfered with. These openings are the palatine, anterior and posterior, in the upper jaw, and the mental in the lower jaw, bicuspid buccal region. Relief may be given either by scraping the impression or placing foil on the model. In caring for the mental area, we need to safeguard peripheral seal or contact.

Factor 3 refers to traumatic occlusion, and this cannot be ignored with safety. In the early recognition of three-point contact, it seems that dentists had in mind stability only. Later, balanced occlusion and cuspal interference were included.

It is generally recognized that this phase of our work needs careful attention to save the ridges from trauma, but we disagree with any one who holds that this is the only cause of progressive resorption under a denture, as we do with one who believes that traumatic occlusion causes all pyorrhea. If such theory is true, it follows that the tooth with no antagonist cannot develop pyorrhea; nor can the patient with no teeth whatsoever or wearing one plate only be afflicted with progressive resorption. If you can translate no occlusion into traumatic occlusion, we do not speak the same language, and, mind you, we have yet to hear from another member of our quartet, dietary imbalance.

Several years ago, a writer in the A.D.A. JOURNAL cited an instance in which an edentulous woman found it necessary within eight years, on account of progressive resorption, to have five plates made, representing the efforts of five high-class men. The last solved the problem by instituting treatment for calcium-phosphorus deficiency.

I quote Dr. Ostrem[1]:

> The type of bone found in pyorrhea cases usually means rapid absorption under a denture and changes in the denture will be required in much less than the usual time. In this type of case, there is usually a very definite lack of calcium.
>
> In normally calcified bone, when teeth have been lost, usually from excessive decay, but seldom from pyorrhea, there is less change to be dealt with later. While a great deal is not known about calcium metabolism, I have found, in the past twelve years, that there is a very definite help to be obtained by placing the patient on a diet of calcium and capsules of cod-liver oil. It seems to allow the sockets, even in pyorrhea cases, to fill in more quickly with bony structure. This treatment has been found valuable even prior to extraction of teeth. It has been routine practice in my office for several years to place the patient on this form of treatment before extraction and to continue it for several months after the dentures are completed. In a series of more than 200 test cases, I have had ample proof of the difference it makes in the reaction to extraction, rapidity of healing and the general health of the patient through the whole procedure.

Nina Simmonds[2] writes:

> The so-called average diet leaves much to be desired as far as optimum nutrition is concerned. . . . It is, of course, fully understood that adequate nutrition can no more stimulate the jaw to grow a new ridge when the original ridge has been removed surgically or has been completely resorbed than it could cause a finger to grow a new joint to replace one that has been amputated. . . . The body must have, among other things, liberal amounts of calcium, phosphorus, and vitamins C and D before good bone can be built or maintained.

Today, to simplify prescribing, the dentist is furnished, in small capsule form, placed alternately in a small vial, the accepted vitamins (dark) and the desired minerals (light) in proper proportions

and combinations, one of each to be taken once a day. For the patient, this is a very convenient arrangement, and the treatment may be commenced two weeks prior to extraction and continued for three months, independently of the time of denture insertion. This would be a conservative procedure and, I believe, prove beneficial.

However, just how the desired balance in cell activity between the osteoblasts and the osteoclasts may be achieved is beyond my ken. I surmise that it may be safely entrusted to Mother Nature, who has a way of preventing the blacksmith's arm from becoming a monstrosity.

In any branch of dental practice today, a more comprehensive view and grasp are required than fifty years ago, and to him of narrow vision, we tender this excerpt from Pope's "Essay on Man":

Thus man, who here seems principal alone,
Perhaps acts second to some sphere unknown;
Touches some spring, or verges to some goal;
'Tis but a part we see and not the whole.

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SUPERNUMERARY ANOMALIES

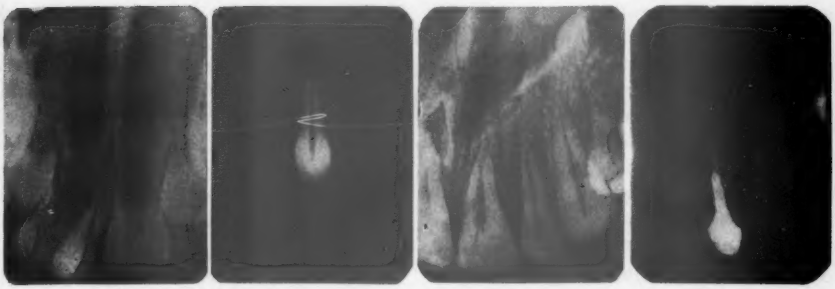
By JULIUS L. HENDLER, D.D.S., Brooklyn, N. Y.

SUPERNUMERARY anomalies of the teeth of the maxilla,[1] are not uncommon, the most characteristic usually resembling the deciduous cuspid in shape. They are found in the anterior region usually at or near the midline. Faught[2] calls these teeth atavistic, atavism being defined as "a long distance heredity." Illustrative of this type of anomaly, we see, in Case 1 (Fig. 1 a and b), the roentgenograms of a boy, aged 6½, with the supernumerary tooth fully developed as shown by the postextraction roentgenogram (Fig. 1 b) of the removed tooth. This case is of special interest since most of the teeth are not observed until the patient reaches adult age, and thus no clue is present as to the time of development. In this case, we know that the supernumerary tooth preceded the normal permanent anterior teeth. These teeth may or may not be impacted.

In the same region, but rather infrequently, we find a small almost rounded tooth, usually at the apex of the central incisor. Case 2 is of this type (Fig. 1 c), but it is further noteworthy in that the supernumerary tooth was causing resorption of the apex of the adjoining tooth.

Anomalous supernumerary teeth of various sizes and shapes may also be found in the anterior region of the maxilla. Case 3 (Fig. 1 d) shows a rather interesting condition in that the impacted tooth, anomalous in shape, is inverted in position, the crown facing palatally.

The posterior region of the maxilla is also a common site for supernumerary anomalies, the supernumerary bicuspid usually resembling a well-formed bicuspid, as shown in Case 4 (Fig. 2 a and b). Supernumerary molars, however, rarely resemble molars, but are usually miniature caricatures of teeth, having enamel, dentin, cementum and pulp structures laid down in the characteristic manner. This is true of most supernumerary



a b c d

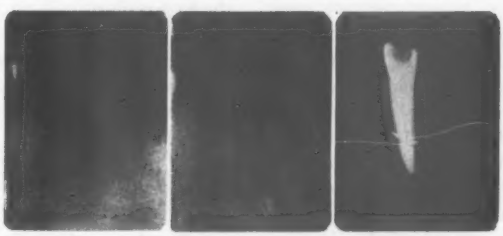
Fig. 1.—Case 1: a, supernumerary tooth fully formed and erupted and of typical shape of supernumeraries usually found in this region, in midline of maxilla in boy aged 6½. b, roentgenogram of tooth after extraction. Case 2: c, impacted supernumerary tooth at apex of central incisor causing resorption of adjacent tooth. Case 3: d, impacted inverted supernumerary tooth in region of maxillary cuspid.

a b c

Fig. 2.—Case 4: a, supernumerary bicuspid tooth closely resembling normal bicuspid. b, postextraction roentgenogram of tooth. Case 5: c, supernumerary molar buccally from second molar.

a b c

Fig. 3.—Case 6: a, two impacted supernumerary anomalous teeth distally from third molar—left side of maxilla. b, tissue impacted supernumerary buccally from third molar, right side of maxilla. c, roentgenogram of supernumerary tooth from right side, after extraction.



a b c

Fig. 4.—Case 7: a, supernumerary anterior tooth in midline of mandible. Case 8: b, roentgenogram showing supernumerary mandibular lateral incisor. c, postextraction roentgenogram of supernumerary tooth showing normal incisor structures.

anomalies. The rudimentary molar is usually distal to the third molar and may or may not be impacted. A series of these cases have previously been reported.[3] However, the supernumerary tooth may take another position, usually buccal to the third molar. Case 5 (Fig. 2 c) is that of a supernumerary tooth buccally from the second molar.

Supernumerary molars may be bilateral. In Case 6 (Fig. 3 a, b and c), we have an unusual condition wherein, on the left side, two supernumerary teeth are present distally from the third molar; whereas, on the right side, a miniature specimen is present buccally from the third molar.

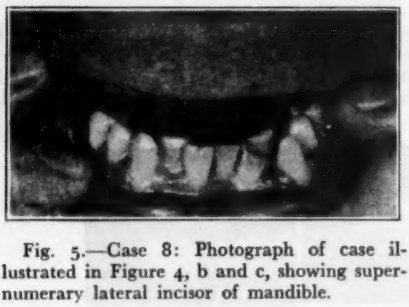


Fig. 5.—Case 8: Photograph of case illustrated in Figure 4, b and c, showing supernumerary lateral incisor of mandible.

Supernumerary anomalies of the mandible are relatively rare. Infrequently seen are seven anterior teeth, with the supernumerary tooth difficult to distinguish from a normal tooth. In Case 7 (Fig. 4 a), the supernumerary tooth seems to be in the midline; whereas in Case 8 (Fig. 4 b and c; Fig. 5), the supernumerary tooth seems to be an additional lateral incisor, for the decayed tooth illustrated in Figure 4 c approaches the 6.9 mm. mesiodistal measurement of the lateral incisors rather than the 5.9 mm. width of the central incisors.

Supernumerary anomalies of the posterior region of the mandible are extremely rare and few reports are to be found in the literature. Case 9 (Fig. 6 a and b) involved the smallest of supernumerary teeth, not involved in cyst formation, that I have observed. The supernumerary tooth is between the left first bicuspid and the second deciduous molar. Figure 6 b shows the smallness of the anomalous tooth mesiodistally. Case 10 (Fig. 6 c) was that of an impacted supernumerary tooth of anomalous shape situated between the second bicuspid and the first molar.

a b c

Fig. 6.—Case 9: a, small and thin supernumerary anomalous tooth in bicuspid region of mandible. b, postextraction roentgenogram of supernumerary tooth, showing definite tooth structures. Case 10: c, impacted supernumerary tooth of anomalous shape in posterior region of mandible, situated between second bicuspid and first molar.

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OSTEOMYELITIC CONDITIONS IN THE MANDIBLE

By VAN B. DALTON, D.D.S., Cincinnati, Ohio

IN this fast-moving high-geared world of today, there is greater and greater need for knowledge, for our patients have an ever-increasing eagerness to know. Nearly every writer of late on the subject of osteomyelitis has stressed the importance of the dentist's having a more thorough knowledge of all the tissues of the mouth and a better knowledge of the pathology of these tissues. No intelligent practitioner can gainsay this, for it is one of the most important diseases of the jaw which the dentist is called upon to treat, and which, because of its seriousness, carries with it a great responsibility. It is, therefore, important that the dentist should have an understanding of this disease, and he should be familiar with the symptoms of osteomyelitis to an extent to enable him to make an early diagnosis. His knowledge should enable him to determine whether an acute inflammation, a true osteomyelitis, a necrosis or some other inflammatory bone condition is present.

In order that the patient may receive the best service, it is necessary that the cardinal symptoms of this disease be recognized early. This is of paramount importance, for the symptoms of this disease are so few that it becomes fundamentally important for one to be thoroughly familiar with them. On superficial clinical examination, it is possible to confuse osteomyelitis of the mandible with actinomycosis or a malignant growth such as sarcoma. However, a roentgenogram of the jaw is usually sufficient for differentiation. Should there still be any doubt, a biopsy should be made.

Osteomyelitis is the one major disease with which we are constantly confronted. At the same time, it is one whose phenomena we have not always understood so thoroughly as we should. There is a mechanical aspect of physiology and pathology, and especially is this true in diseases of the bone. Therefore, the dentist should be especially adept in dealing with the many phases of this disease.

In reviewing the literature, we find that osteomyelitis is described as a disease of the long bones. I have no objection to this classification, provided the mandible can be properly classed as a long bone; for, despite its peculiar shape, many of its more important features are identical with those of the long bones. The lower jaw is composed of a heavy outer layer of cortical (compact) bone and an inner softer or cancellous bone having thin walled cells and containing myelitic material which is absolutely identical with that found in the marrow of long bones. The staphylococcus, streptococcus, pneumococcus, Vincent's organisms and mixed bacteria are the organisms most frequently found in osteomyelitis.

In delving into the writings on this subject, it seems strange that all the papers written by dental practitioners have included the maxillae in the description and treatment of osteomyelitis. Not once have I found a dental writer limiting this subject to the mandible. Of course, we have cases closely resembling an osteomyelitis in the upper jaw, where, as a result of injury or infection, bone

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sequestra are formed, but these cases all lack that peculiar spreading tendency found in all true cases of osteomyelitis of the mandible and the long bones. I believe that osteomyelitis *per se* is found only in the mandible and long bones. I lay claim to originality only in the foregoing statement.

This brief preface brings us to a definition. I would define osteomyelitis as a destructive process affecting the periosteum, the cortex and the marrow of bones. It may be either primary or secondary and is caused by infection entering the blood stream or, more directly, by a break in or abrasion of the soft tissues overlying the bone. Peculiarly, osteomyelitis occurs much more frequently in males than in females. In its inception, the patient complains constantly of severe pain, and yet we do not see sufficient cause to justify this complaint. This pain does not shift, but remains localized in one place. Probably this severe pain is the result of gas formation, which immediately precedes the breaking down of infection, the gas being more or less sealed up in the unyielding bone, which cannot readily permit its evacuation. Shortly after the onset of pain, there is an elevation of temperature and the pulse rate may be exaggerated out of all proportion to the rise of temperature. At this point, a blood count will show an increase in leukocytes. Within a few days after these symptoms develop, swelling begins, covering a larger area than that from the usual abscessed tooth. At this point, the patient becomes very much upset, demanding relief from pain.

It is here that the inexperienced operator makes the mistake of doing too much for the patient. Teeth are often needlessly sacrificed at the onset of osteomyelitis. Curetting a tooth socket at the beginning is a dangerous procedure, causing the disease to spread faster and further. Patients do not realize that it requires both time and patience to successfully treat a case of osteomyelitis.

As soon as a diagnosis of osteomyelitis is made, the patient should be told that the disease is usually of long duration. In this way, we should secure better cooperation, and the patient will not be expecting too much in too short a time. We can safely say that occasionally one is lucky enough to recover in a few weeks, but the average case usually runs from four to six months, and may be of even longer duration. I do not mean that we should discourage the patient. After all, the patient's mental attitude will suggest the proper statement.

Causes other than bacterial may be excessive trauma from instrumentation in an attempted removal of impacted third molars, or chemical conditions arising from the use of strong escharotics, or tissue-destroying agents used in root-canal therapy. The most direct cause, of course, is bacterial, and treatment may be facilitated if a differential diagnosis is made. Osteomyelitis has developed in the mandible after the use of hydrogen peroxide in root-canal therapy and again after the injection of procaine preparatory to deep scaling in the treatment of pyorrhea. More often, it has followed the extraction of lower third molars after a mandibular injection when the third molar was incompletely erupted, having an infected gum flap on the distal aspect. We should hospitalize these patients in most cases, especially at the onset, and until the disease becomes somewhat chronic, and keep them in the hospital until drainage is established.

TREATMENT

The severe pain at the onset can sometimes be relieved by determining where in the bone the infection is developing, making an incision down to the bone and then placing a few drill holes just through the cortical layer of bone, and keeping these open with gauze wicks.

Pus will usually be noted after the first twenty-four hours. Sometimes patients will not submit to this operation because,

at this stage of the disease, diagnosis cannot as yet be verified by the x-rays. Of course, if we have to wait for verification by the x-rays, it comes too late and is unnecessary, for if the bone has broken down enough for the condition to be evident on the x-ray plate, swelling has also taken place, and when this happens, the extreme pain subsides and soon disappears altogether. The infection usually spreads rather rapidly, the extension depending, of course, on the virulence of the invading organism and the resistance of the patient.

Dry heat and poultices are always contraindicated. The ice bag should be used at the onset and its use should be continued for a few days, or until there is some indication of localization. As soon as there are definite signs of localization on the outside, application of hot magnesium sulfate packs should be resorted to, in order to hasten pointing. As soon as the pus has definitely localized, free drainage should be established. I prefer a through drain to the outside, because it permits better evacuation of the infectious material, thereby keeping the mouth and the tissues on the inside cleaner. A rubber drain sewed into the edge of the incision at the time of opening facilitates keeping the wound open, as well as encouraging drainage itself. However, selvage-edged iodoform gauze tape, changed each time the jaw is irrigated, is also efficacious. No effort should be made to remove sequestra in the early stages of osteomyelitis of the mandible, because the involucrum is being formed with each sequestrum, and too early removal will prevent bone regeneration and result in jaw deformity at the termination of the disease. Also, permitting the involucrum to form without too much disturbance lessens the danger of a pathologic fracture.

For some time in the past, I have had good results from the use of potassium permanganate as an irrigating solution. Of late, however, I have been using the Fischer-Bledsoe solution, which is described by them as follows: "A fact of importance in the preparation of a surgical irrigation fluid is that different salts, even when employed at the same concentration, are unequally effective in reducing swelling. The salts of magnesium, calcium and strontium, for example, are far more powerful than the corresponding salts of sodium; while still heavier metals, such as iron, zinc and mercury, are the most powerful of all. For this reason, the use of a calcium salt with the sodium chloride in any irrigation fluid yields better results than the use of sodium chloride pure. A mixture of various salts has therefore always been known to be less harmful to living tissue than any salt used singly, as exemplified in the long and favorably known solutions of Ringer and of Lock. But the Ringer solutions commonly used in medical and surgical practice are physiologic mixtures based on the study of amphibian tissue (such as that of turtles and frogs) and are therefore of too low concentration when used on man."

To obtain an irrigating fluid suitable for human use and one that took into consideration the facts briefly outlined here, Fischer and Bledsoe prepared a mixture consisting of sodium chloride, 10.5; calcium chloride, 0.84; potassium chloride, 0.42, and water sufficient to make 1,000 cc.

The Fischer and Bledsoe solution contains the three salts which Ringer originally found so favorable for the maintenance of a physiologic activity in surviving tissues and is, in this respect, therefore, a so-called physiologically balanced mixture. The solution is also "hypertonic" in that the concentration of the sodium chloride has been raised to the point at which it will prevent the swelling of uninjured human cells. The concentration of the calcium chloride is several times that of the original Ringer mixture. This high value is taken in order to maintain the dehydration effects

of the various salts as long as possible; for while monovalent salts, through their more rapid diffusion, affect the inflamed tissues first, the dehydrating effects of calcium last longer, once this salt has diffused into the tissues.

Fischer and Bledsoe found it convenient to have this solution ready in concentrated form. Powder mixtures of the several salts will not keep because calcium chloride is deliquescent. The following is a practically saturated solution of the foregoing salts in the correct proportions: sodium chloride, 263.7 gm.; dried calcium chloride, 21 gm.; potassium chloride, 10.6 gm., and distilled water, sufficient to make 1,000 cc. When desired for use, 20 cc. of this mixture is diluted to 500 cc. with distilled or freshly boiled water and thoroughly mixed. There is no harm in employing the solution in this or still higher concentration, but to employ it in any concentration less than 20 cc. in the 500 cc. of water is to use a solution possessed of all the defects of plain water or an inadequately concentrated salt mixture.

It is best, of course, to irrigate with the mixture at body temperature or a few degrees higher. Since boiling does not affect it, the stock or finished solution may be readily sterilized. It is well to remember also that the diffusion of salts into tissues takes time and that prolonged contact with the tissues is favorable to this end. As much time as possible should therefore be allowed between the separate fractions of an irrigation.

Internally, potassium iodide is useful in breaking down adhesions in chronic glandular involvement. It seems to assist in melting these hard lymph nodes. The dosage is 10 drops of a saturated solution three times a day.

At this point, I should like to utter a word of caution against the needless removal of vital teeth even though they are quite loose. In some cases, I have been able to save the teeth, even though they were so loose as to require splinting. Also, I would say a word of caution against permitting patients to massage the scar where the opening to the outside has healed until several weeks after the patient is considered absolutely well.

I wish now to recite three case histories, two of which are typical and one of which is unusual.

REPORT OF CASES

CASE 1.—*History.*—A man, aged 46, came to his dentist with a violent pain in the left lower jaw. On examination, the dentist found a loose and very sore left lower third molar. He injected procaine and, without undue trauma, removed the tooth. The patient complained at the time that the anesthesia had not been complete and that there was a great deal of pain during the extraction, although all signs of anesthesia were present before extraction of the tooth. The pain in the jaw persisted, and, the second day after the extraction, swelling began in the lower left jaw, daily increasing in size until there was a gross swelling extending from the median line, past the angle of the jaw and down into the neck. The dentist irrigated the mouth and gave palliative treatment. After this condition had been present for seven days, I was called in consultation.

Examination.—The patient presented a typical cellulitis, with a hard massive swelling of the jaw and neck and a temperature of 104° F.

Treatment.—I immediately sent the patient to the hospital and applied hot magnesium sulfate dressings. Within less than forty-eight hours, there was a fluctuating point immediately beneath the lower border of the mandible at its angle. An external incision was made, free pus obtained and a rubber drain placed. The hot dressings were continued.

Within four days, the patient was able to leave the hospital, as the pain had subsided and the temperature was back to normal. However, drainage of free pus continued. A roentgenogram was taken and the bone appeared normal, as is always the case this early in the development of an osteomyelitis of the jaw. Postoperative care consisted of drainage and irrigation. In two weeks, another roentgenogram revealed a vast and extensive involvement of the body of the man-

dible and ascending ramus. This was treated in the usual manner, with removal of sequestra as they appeared, and an occasional x-ray check-up was made.

Outcome.—The patient, during this time, was able to return to his position and, in about four months, the last sequestrum was removed. The wound was allowed to heal and, with the exception of a small scar, which is rapidly disappearing, there are no visible defects.

CASE 2.—*History.*—A white woman, aged 48, came in August 5, 1939 with a gross boardlike swelling of the right side of the jaw and neck. The temperature was 103° F. The patient was suffering greatly.

One week previously, the patient had gone to the family dentist with a sore and highly inflamed area about the lower right third molar. No swelling was noted. The dentist injected procaine for a mandibular block injection, and removed the third molar, which was quite loose. The next day, the pain continued and, on the third day, swelling began, becoming increasingly worse. The dentist had been irrigating the mouth with potassium permanganate and applying an ice bag on the right jaw.

Treatment.—August 5, the day that I was called in on the case, the patient was sent to the hospital and hot magnesium sulfate dressings were applied to the outside of the jaw. Fluids were prescribed and a cathartic was given, with codeine, 1 grain, as required.

August 6, an external incision at the shadow line of the right mandible yielded copious free pus. A drain was placed.

August 8, the patient was sent home from the hospital.

August 12, an x-ray film of the jaw was negative. The swelling was greatly reduced. The patient was free from pain and there was copious drainage. There was daily treatment of the mouth, irrigation and change of dressings.

August 27, x-ray examination revealed osteomyelitis of the right side of the mandible involving the angle and ascending ramus. The Wassermann reaction was negative.

August 30, an internal incision was made and a through-and-through drain placed.

September 25, sequestra were removed, as indicated by the x-rays. During this time, dicalcium phosphate and viosterol were prescribed.

October 9, a large sequestrum was removed.

November 6, the last sequestrum removed.

Outcome.—Recovery was uneventful.

November 19, the patient was dismissed as well.

February 12, x-ray examination revealed complete repair of the mandible.

CASE 3.—*History.*—A white man, aged 55, came in June 27, 1938, with a swelling of entire lower jaw. A little more than two months previously, the patient had all of the lower teeth extracted. A cellulitis ensued, but no external incision had been made, and there had been a spontaneous opening into the mouth, with the flow of pus persisting until finally the bone from cuspid to cuspid had become denuded and necrotic.

Examination.—The alveolar ridge was completely exposed into the mouth from cuspid to cuspid area. The bone was very black and definitely necrotic. Pus flowed freely into the mouth. There was definite fluctuation at the lower border of the mandible slightly left of the median line.

Treatment.—Under nitrous oxide and oxygen, a large sequestrum was removed, as above described. An external incision was made to facilitate drainage, the wound was irrigated with allantoin solution and packed with gauze saturated in allantoin jelly, both externally and internally. As the patient lived about 100 miles from Cincinnati, it was impossible for him to get in oftener than once a week, and so it was necessary for the treatments to be carried on by his local physician and dentist. Although this was an unsatisfactory arrangement, it was the best that could be made.

July 2, 1938, several small sequestra were removed.

July 17, another sequestrum was removed.

September 16, another external incision was made and a rubber drain placed.

Between the times that I saw the patient, the external incision was allowed to close and, according to the roentgenograms, the area involved was almost the entire body of the mandible, including a portion of the ascending ramus on each side.

October 5, October 20 and October 27, sequestra were removed. During this time,

to the best of my ability, under the existing conditions, irrigation and drainage were maintained.

December 9, another large sequestrum, shown by a roentgenogram to be ready, was removed. January 18, 1939, I consulted an orthopedic specialist, who advised continuance of the treatments.

February 14 and March 10, sequestra were removed.

Outcome.—June 16, the last sequestrum was removed. Formation of pus ceased and the healing of the soft tissues was uneventful. The greater part of the body of the mandible to and including the angles of both sides was completely destroyed and no regeneration took place. This case had been allowed to get a good start, and because of the patient's inability to come in regularly, it was impossible to maintain drainage. However, after experiencing a year and a half of drainage of pus into the mouth, the patient felt that he was well rewarded to have this condition stopped, and to him the outcome was satisfactory.

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FOLLOW-UP STUDIES OF ROOT-FILLED TEETH IN RELATION TO BACTERIOLOGIC FINDINGS

By FRED W. MORSE, JR., M.D., and MORTON F. YATES, D.M.D., Boston, Mass.

ROOT-CANAL therapy is hardly justifiable unless careful, consistent checks are made at proper intervals, following the completion of the treatment. Such checks are of value in that they offer an excellent opportunity to study what takes place after treatment is completed, in the light of the original pathologic condition and the types of bacteria present in the canal during treatment.

It has been the policy at Harvard in root-therapy cases to have the patient return for clinical and roentgenographic check at least once a year after the root filling is placed. Some of these cases have been observed over a period of seven years. In this manner, we are better able to measure the results of treatment and to draw some useful conclusions regarding root-canal therapy in general.

Our policy governing all root therapy involves first a careful selection of patients. It has been said that "it is more important to know what kind of patient has a given disease than to know the disease." When a patient presents himself for treatment, a careful and thorough study of the mouth is made. This study includes both a clinical and a roentgenographic examination. A thorough physical history is taken and, from the foregoing information, the patient's fitness for treatment is determined.

Every treatment is carried out under strict asepsis in order to validate the results of bacteriologic tests. The progress of treatment is checked at each visit by bacteriologic cultures. After incubation, positive growth is planted on blood-agar plates and the types of organisms found are reported to the student on service in the clinic of the bacteriology department.

Until negative bacteriologic reactions are obtained, the only therapy employed is a careful flushing and cleansing of the canal followed by dressing with a suitable medicament. At least two consecutive negative bacteriologic reactions are obtained before the canals are filled. Such a procedure is sound and has the endorsement of workers in the profes-

From the Harvard University Dental School.

sion who have reported from time to time in the literature: Appleton, Blayney, Buchbinder and Wald, Coolidge, Grossman, Sommer and others.

In the light of modern scientific research, root-canal therapy can be attempted only under conditions of strict asepsis and when the progress of treatment is bacteriologically checked. The old method of determining the condition of the canal by the absence of odor or moisture can no longer be deemed adequate, in the light of present knowledge of biologic processes.

In the literature, it has been repeatedly pointed out by several workers that root therapy with bacteriologic control is not too difficult a procedure for use in the office of the general dental practitioner. An outline of our procedure follows.

ROOT-CANAL THERAPY PROCEDURE

Selection of cases: Data collection; complete oral history, physical history and roentgenographic survey; diagnosis.

Treatment: All operations are carried on under strict asepsis to validate bacteriologic findings.

First visit (pulp vital): 1. Administer anesthetic as indicated.

(a) Nerve block.
(b) Infiltration.
(c) Pressure with dam in position.

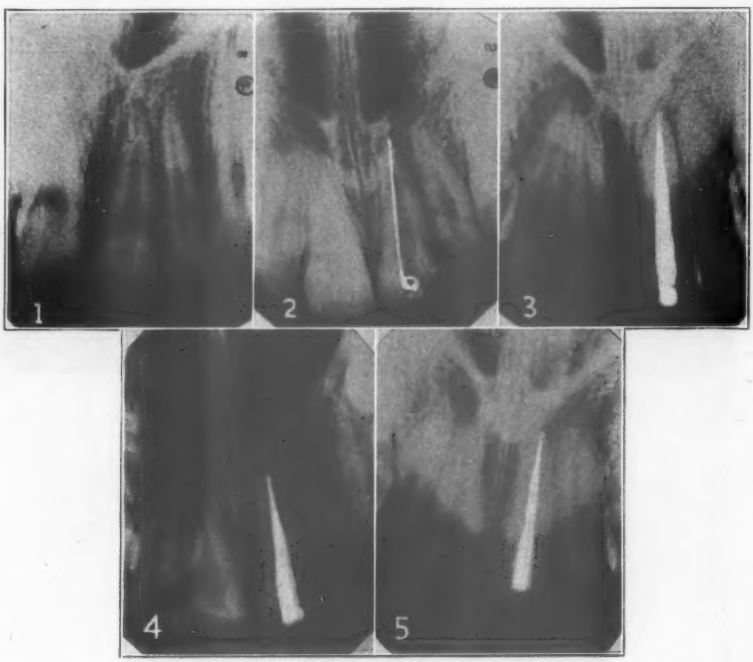

Fig. 1 (Case 1).—1 (October 25, 1937), initial roentgenogram. 2 (November 15, 1937), measurement wire. 3 (November 19, 1937), root canal filled. 4 (February 8, 1939), first follow-up roentgenogram. 5 (March 13, 1940), second follow-up roentgenogram.

2. Place roentgenogram in holder in full view.
3. Adjust the rubber dam; paint the field with iodine.
4. Open into the pulp chamber.
5. Test anesthesia with a pic.
6. Extirpate the pulp.
7. Take a culture of the canal.
8. Mechanically cleanse the canal.
9. Wash or flush the canal with surgical

solution of chlorinated soda (Dakin's).

10. Dry the canal with sterile paper points.

11. Apply the medicament as directed.

12. Seal the tooth with cement.

Second visit (non-vital case): 1. Place roentgenogram in holder in full view.

2. Adjust the rubber dam; paint the field with iodine.

3. Open the tooth and take cultures.

4. Wash or flush canal with surgical solution of chlorinated soda.

5. Mechanically cleanse the canal.

6. Wash or flush the canal with surgical solution of chlorinated soda.

7. Dry the canal with sterile paper points.

8. Apply the medicament as indicated.

9. Seal the tooth with cement.

Third visit: If the bacteriologic reactions of the canal were positive, repeat the foregoing treatment until negative reactions are obtained.

Third visit (negative cultures): 1. Place roentgenogram in holder in full view.

2. Adjust the rubber dam; paint the field with iodine.

3. Open the tooth. Take cultures of the canal, old and new.

4. Wash the canal with surgical solution of chlorinated soda.

5. File the canal to proper size and shape.

6. Wash or flush the canal with surgical solution of chlorinated soda.

7. Dry the canal with sterile paper points.

8. Place a measurement wire in the canal.

9. Apply the medicament as indicated.

10. Seal the tooth with cement.

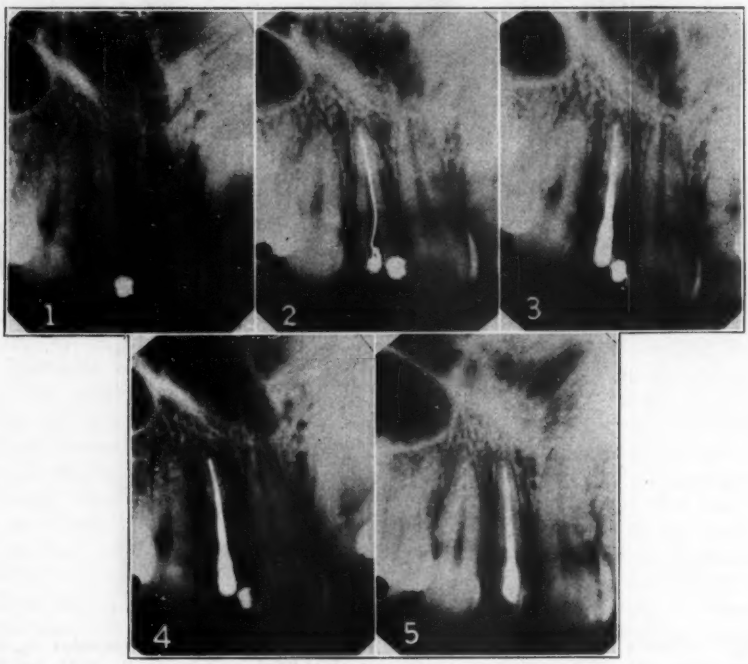

Fig. 2 (Case 2).—1 (May 3, 1937), initial roentgenogram. 2 (May 17, 1937), measurement wire. 3 (May 19, 1937), root canal filled. 4 (January 21, 1938), first follow-up roentgenogram. 5 (April 17, 1940), second follow-up roentgenogram.

11. Refer the patient to the x-ray department for a measurement wire roentgenogram.

Fourth visit: 1. Place measurement wire roentgenogram in holder in full view.

2. Adjust the rubber dam; paint the field with iodine.

3. Open the tooth.

4. Remove the measurement wire.

5. Wash the canal with surgical solution of chlorinated soda.

6. Dry the canal with sterile paper points.

7. Fill the canal with gutta-percha.

8. Roentgenograph the tooth with the rubber dam in position to determine the length of the gutta-percha filling.

9. Complete the root-canal filling.

10. If satisfactory, seal the tooth with cement.

11. Refer the patient to the x-ray department for a final check and instruct him to return for roentgenographic checks.

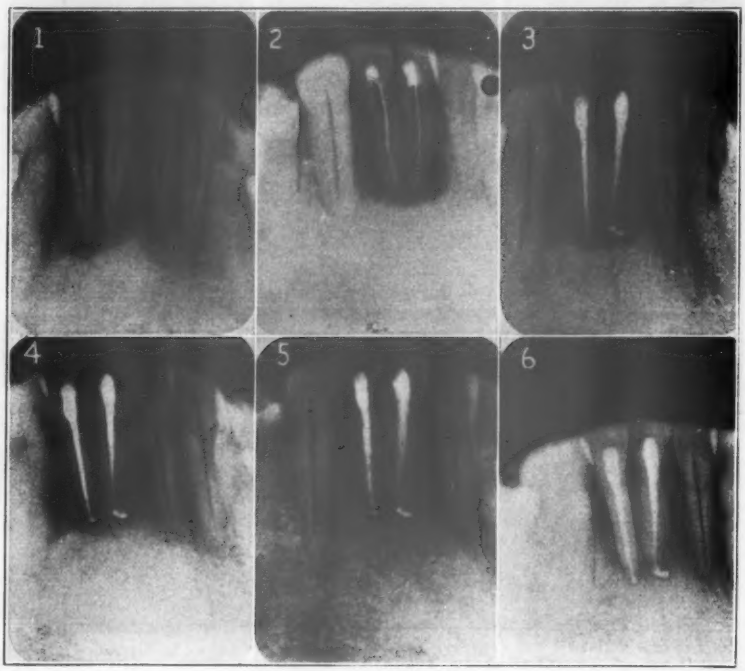

Fig. 3 (Case 3).—1 (November 14, 1937), initial roentgenogram. 2 (December 9, 1937), measurement wire. 3 (December 19, 1937), root canal filled. 4 (March 10, 1939), first follow-up roentgenogram. 5 (November 29, 1939), second follow-up roentgenogram. 6 (April 25, 1940), third follow-up roentgenogram.

For a detailed description of bacteriologic tests for root-canal sterility and an aseptic technic, we refer the reader to an article by us in THE JOURNAL.[1]

ORIGINAL ROENTGENOGRAPHIC CONDITION

Our cases, when first examined, may be classified in one of the following groups:

1. Normal. Cases giving no roentgenographic indication of changes in the radiolucency of the periapical bone, with a clear and unbroken lamina surrounding the root apex.

2. Circumscribed radiolucency. Cases with roentgenographic evidence of a marked area of radiolucent bone and a definite line of demarcation between the normal and the pathologic bone.

3. Diffuse radiolucency. Cases with roentgenographic evidence of radiolucent bone, not sharply defined, more or less blending into the normal surrounding bone.

We further include a number of cases classified under the terms "acute alve-

olar abscess," "cysts" and "undeveloped apex."

In the 265 cases studied, the original roentgenographic condition as shown was as follows: normal periapical bone, twenty-eight; circumscribed radiolucency, fifty-nine; diffuse radiolucency, 170; miscellaneous, eight.

FOLLOW-UP PROCEDURE

When the treatment is completed and the root filling has been placed, followed by the final roentgenogram showing a thoroughly filled canal, the patient is advised that he will be requested at certain intervals to return to the school for check-ups. This form of letter is employed:

Dear Mr. ————:

Some time ago, you had a root-canal treatment at Harvard Dental School which, we trust, has made the tooth quite comfortable and useful. For the sake of your general health, the tooth should be x-rayed at this time to be certain that the conditions at the end of the root are healthy and normal.

Immediately following the treatment, it is impossible to see in the x-ray picture thoroughly healed tissue at the end of the root. Such a healing of this tissue is very important to your general health and well-being. Health is one's most valuable possession, and it is to safeguard it that we wish to be very sure that there is nothing about the treated tooth that might be injurious or harmful.

Such a follow-up x-ray picture will be taken at no expense to you.

Kindly come to the school on ———— and ask for me.

Sincerely,

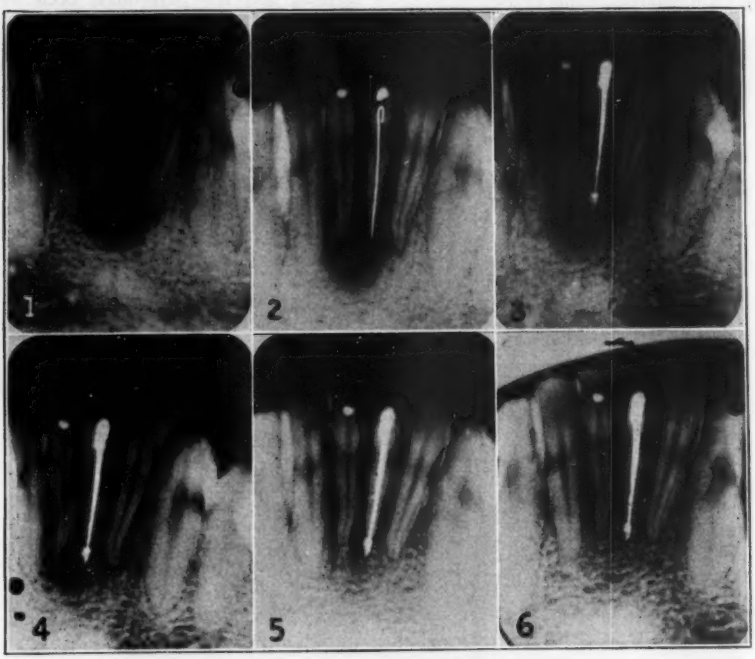

Fig. 4 (Case 4).—1 (October 19, 1936), initial roentgenogram. 2 (November 6, 1936), measurement wire. 3 (November 16, 1936), root canal filled. 4 (May 5, 1937), first follow-up roentgenogram. 5 (April 20, 1938), second follow-up roentgenogram. 6 (March 29, 1939), third follow-up roentgenogram.

By placing the follow-up clinic on these grounds, a very fine response to our letter is obtained.

CLASSIFICATION

We are reporting on 265 cases in which the patient has returned for these check-ups. Fifty-seven patients have returned for three or more follow-up visits; sixty-five for two, 143 for one follow-up examination. Of these 265 cases, forty-six have been observed for from nine months to one year after the root canal was filled; ninety-seven, from one to two years; sixty-three, from two to three years; twenty-six, from three to four years; fourteen, from four to five years; twelve, from five to six years; five, from six to seven years, and two for more than seven years. It is our policy to have these patients return for follow-up checks as long as they are available.

In the follow-up studies, all previous roentgenograms are sent to the x-ray department in order that similar angulation and exposure conditions may be obtained. We classify the roentgenographic results as follows:

1. Normal (N), cases giving no roentgenographic indications of change in radiolucency of the periapical bone, with a clear and unbroken lamina surrounding the root apex.

2. Plus-minus (+−), cases in which no improvement is noted. It does not, however, always indicate that there has been retrogression since the root-canal filling was placed. These cases are carefully studied and the patients requested to return for further checks at shorter intervals. If, after sufficient time, the case shows no improvement, the tooth is extracted.

3. Plus (+), cases in which there is positive improvement. The largest group is in this classification. The original roentgenogram must have shown a condition of definite bone involvement. These are the cases which show improvement, with a definite reduction in the area.

4. Two-plus (+ +), cases showing

TABLE 1.—RESULTS IN "FIRST FOLLOW-UP" GROUP

Initial Condition	Follow-Up Results					
	+−	N	+	++	Total	Per Cent
Normal	0	19	0	0	19	13.3
Circumscribed radiolucency	4	0	11	22	37	25.8
Diffuse radiolucency	7	0	64	15	86	60.2
Acute abscess	0	0	1	0	1	0.7
Cyst	0	0	0	0	0	
Undeveloped apex	0	0	0	0	0	
					143	

TABLE 2.—RESULTS IN "SECOND FOLLOW-UP" GROUP

Initial Condition	Follow-Up Results					
	+−	N	+	++	Total	Per Cent
Normal	0	4	0	0	4	6.1
Circumscribed radiolucency	0	0	1	8	9	13.8
Diffuse radiolucency	4	0	35	12	51	78.6
Acute abscess	0	0	0	0	0	0.0
Cyst	0	0	0	0	0	0.0
Undeveloped apex	0	1	0	0	1	1.5
					65	

very marked improvement during the period observed, both clinically and roentgenographically. In many cases, there has been a complete return to normal as far as can be roentgenographically determined.

The follow-up results in the 265 cases are as follows:

1. Normal, 32 or 12 per cent (normal bone).

2. Plus-minus, 19 or 7 per cent (no improvement).

3. Plus, 138 or 52 per cent (definite improvement).

4. Two-plus, 76 or 29 per cent (marked improvement).

COMPARISON OF RESULTS

Further consideration of the follow-up results may be of interest. In the "first follow-up" group, which is usually checked about one year after the completion of the treatment and the filling of the canal, the results are as shown in Table 1.

It will be noted from the figures in Table 1 that the cases which we classify as "plus," or those cases showing some improvement, are more numerous in the diffuse group, while the "two-plus" cases, or those cases that show marked improvement, are more frequent in the circumscribed group. In other words, it would appear that the circumscribed group show a more rapid and marked improvement, even after one year's time, than the diffuse group. These figures, it will be noted, hold the same ratio in the other follow-up groups.

In the "second follow-up" group, by

TABLE 3.—RESULTS IN "THIRD FOLLOW-UP" GROUP

Initial Condition	Follow-Up Results					
	+−	N	+	++	Total	Per Cent
Normal	0	5	0	0	5	8.8
Circumscribed radiolucency	0	0	3	10	13	22.8
Diffuse radiolucency	4	0	24	5	33	57.9
Acute abscess	0	0	0	0	0	0.0
Cyst	0	0	1	1	2	3.5
Undeveloped apex	0	4	0	0	4	7.0
					57	

TABLE 4.—INITIAL CONDITION AND FOLLOW-UP RESULTS

Initial Condition	Follow-Up Results			
	+−	+	++	Total
Circumscribed radiolucency	4	15	40	59
Percentages	6.6	25.4	68.0	
Diffuse radiolucency	15	123	32	170
Percentages	8.8	72.4	18.8	

TABLE 5.—DATA AND CIRCUMSCRIBED DIFFUSE AND NORMAL GROUPS*

Initial Condition	Cases	No Organisms	Single Organism	Mixed Organisms
Circumscribed group	59	31 (53 per cent)	15 (25 per cent)	13 (22 per cent)
Diffuse group	170	33 (19 per cent)	24 (15 per cent)	113 (66 per cent)
Normal group	28	10 (36 per cent)	4 (14 per cent)	15 (50 per cent)

*Eight cases of cyst, acute abscess and undeveloped apex omitted.

which we mean those cases checked up two or more years after the completion of treatment, the ratio is shown in Table 2.

Table 3 shows the results obtained in the "third follow-up" group. These cases have been checked three times, from three to seven years after completion of treatment.

Two important points are brought out by the data so far presented. The first, which comes from the figures in Tables 1, 2 and 3, is expressed in tabular form below.

It will be seen that 68 per cent of the total circumscribed radiolucency cases showed marked improvement, while only 19 per cent of the diffuse radiolucency cases showed the same degree of improvement in the same length of time after treatment.

The other and more important point, shown in the follow-up results in 265 cases, is that only 7 per cent of these cases show no improvement.

BACTERIOLOGIC METHODS

In considering the bacteriologic condition of root canals, it is of interest to note the frequency with which the organisms are found by our aerobic method, which may be outlined as follows: With a strictly aseptic technic, culture material is taken from the canal by the insertion of a sterile paper point. The point is taken from the canal, carrying its sample of material, and placed in a tube of infusion broth, prepared in

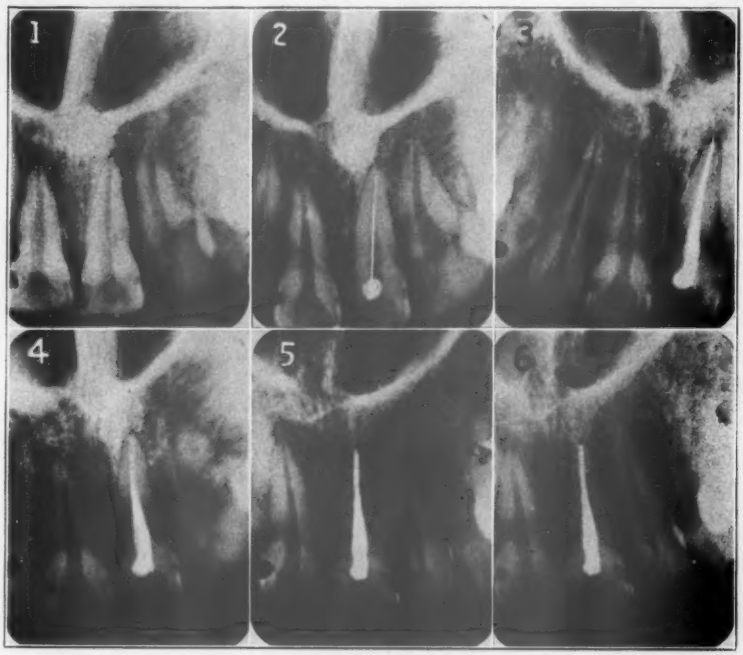

Fig. 5 (Case 5).—1 (November 20, 1935), initial roentgenogram. 2 (January 8, 1936), measurement wire. 3 (January 16, 1936), root canal filled. 4 (March 24, 1937), first follow-up roentgenogram. 5 (May 10, 1938), second follow-up roentgenogram. 6 (February 29, 1940), third follow-up roentgenogram.

the standard fashion, with a pH of 7.6. This broth contains 1 per cent of dextrose. At the second visit, the old paper point, which was sealed in the canal at the last visit, is cultured; and new culture material is taken on a sterile paper point. These cultures are referred to as the "old" and "new" cultures. Thus, from the practical standpoint, we have duplicate cultures made at every visit of the patient except the first. The tubes are incubated for seventy-two hours unless growth appears before that time. Usually, growth appears in twenty-four hours, but, from time to time, growth will not be evident until the third day. Therefore, results must not be considered final until after seventy-two hours of incubation. A few cases have first shown growth as late as the fifth day. If desired, and to carry the bacteriologic test farther, the positive cultures may be planted on blood-agar plates for further study of the types of organisms present in the canals. This has been the procedure in the cultures reported here.

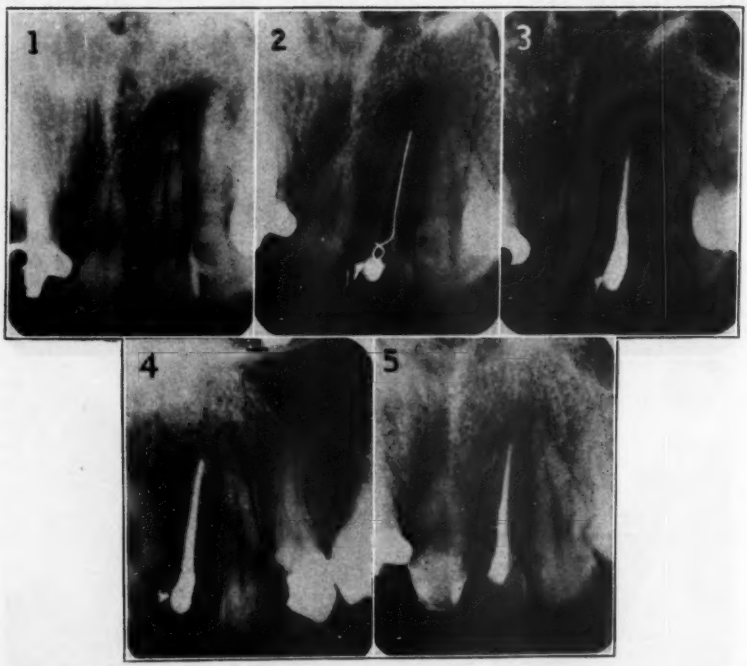

Fig. 6 (Case 6).—1 (March 21, 1934), initial roentgenogram. 2 (May 2, 1934), measurement wire. 3 (May 16, 1934), root canal filled. 4 (October 15, 1934), first follow-up roentgenogram. 5 (May 15, 1936), second follow-up roentgenogram.

CLASSIFICATION OF BACTERIA

We have believed that, in this type of work, a simple classification of the streptococci was all that could well be carried out. Hence, the streptococci are grouped as alpha, beta and gamma according to the type of reaction. Because we are dealing with a considerable number of cultures, we have carried out our identification by surface growth on streak plates of horse blood-agar. This, of course, modifies the method of streptococcus identification of Brown, since pour

plates have not been used. The reactions on the blood-agar have been interpreted on the basis of the description of types to be found in Appleton's book, "Bacterial Infection."[2]

The alpha type of streptococcus, commonly known as *Streptococcus viridans,* is identified by a zone of greenish or brownish methemoglobin around the colony. The beta type is the hemolytic streptococcus, usually considered the most virulent of the streptococcus types. This organism occurs rarely in our study of cases and has not been associated with any particular or severe reaction. The colony produces a clear zone of hemolysis. The gamma type is the nonhemolytic streptococcus, giving no reaction on the blood-agar around the colony. The gamma type is by far the most common organism found by us in root-canal cultures.

BACTERIOLOGIC RESULTS

In the 265 cases which we now present, a total of 2,202 cultures were made, or about eight cultures for each case. Of these, 762 were positive and 1,440 were negative. We should expect an excess of negative results, because every case had to have two consecutive negative cultures before it was declared ready for root filling. The "old" cultures gave 339 positive and 707 negative results, or about a 1 :2 ratio. The "new" cultures gave 423 positive and 733 negative results. As has been stated, we have an "old" and a "new" culture made at each visit of the patient. Both of these cultures must be negative to consider the

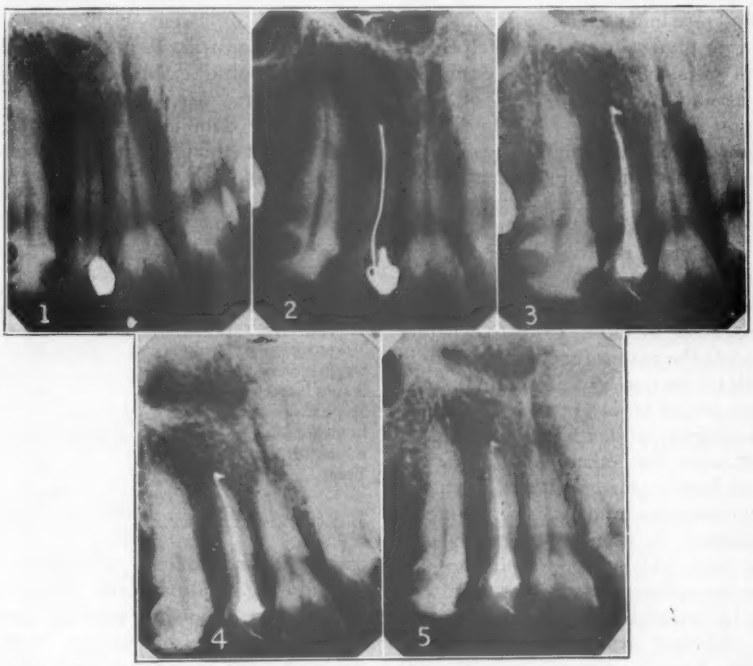

Fig. 7 (Case 7).—1 (December 3, 1937), initial roentgenogram. 2 (January 13, 1938), measurement wire. 3 (January 24, 1938), root canal filled. 4 (December 2, 1938), first follow-up roentgenogram. 5 (March 13, 1940), second follow-up roentgenogram.

treatment as having negative results.

One of the most interesting observations was the number of cases that were always negative, giving no positive results at any time during the course of treatment. Seventy-seven of the 265 cases, or 29 per cent, gave no positive culture. When we have assumed the presence of bacterial infection in the root-canal cases that we accept for treatment, it is somewhat surprising and perhaps puzzling to find no pathogenic organisms present in such a large percentage of cases. In the reports of Sommer,[3] and in the excellent review of focal infection by Reimann and Havens,[4] it is pointed out that many teeth which do not show bacterial infection are condemned. From Sommer's[3] figures, we note that a considerable number of cases give completely negative results, just as in our own observations. Further study should be made of the negative cultures by anaerobic methods, to learn whether this is not the reason for failure to obtain growth by routine aerobic methods. Such a study would be of great importance to our knowledge of dental infection, and it is our hope that others will follow the lead of Buchbinder and Wald[5] in studies of the frequency and types of anaerobic organisms to be found in root canals.

We have had an opportunity on only a few occasions to study root-canal cultures by anaerobic procedure and then have obtained growth in but few instances. Usually, our results with anaerobic cultivation have been the same as with aerobic methods, but this question must be answered before any conclusions can be drawn about the high incidence of negative cultures.

COMPARISON

An interesting comparison appears between the number of cases giving no positive results and the original roentgenographic condition. For example, in the group of cases classified under "circumscribed radiolucency," out of a total of fifty-nine cases, thirty-one showed no micro-organisms present in the canal. Fifteen cases showed single-organism and thirteen showed mixed cultures. In the "diffuse radiolucency" group, out of 170 cases, only thirty-three showed no positive cultures, twenty-four showed single-organism cultures and one hundred and thirteen showed mixed cultures. In the group showing an apparently normal original roentgenographic condition, out of a total of twenty-eight cases, ten showed no growth, four showed single-organism cultures and fourteen gave mixed cultures.

From the data in Table 5, it would appear that the "circumscribed radiolucent" group showed 53 per cent of cases with no bacteria present at any time during treatment and 25 per cent of the cases showing bacteria present were single-organism cultures, while 22 per cent were mixed cultures; whereas, in the "diffuse radiolucent" group, only 19 per cent of the cases gave no growth, 15 per cent showed single organisms and 66 per cent showed mixed cultures.

TABLE 6.—SINGLE ORGANISM CULTURES

	Number	Per Cent
Streptococcus type gamma	158	41
Streptococcus type alpha	46	12
Streptococcus type beta	3	1
Staphylococcus albus	86	22
Staphylococcus aureus	30	8
L. acidophilus	16	4
B. subtilis	27	7
Yeast	22	5
Total	388	

In the normal group, 36 per cent of cases showed no growth; 14 per cent were single-organism cases, and 50 per cent gave mixed cultures. It seems from the foregoing figures that the group with the original roentgenographic condition, which we term "circumscribed radiolucency," has a much higher percentage of cases showing no organisms present,

TABLE 7.—MIXED CULTURES

Streptococcus type gamma and Staphylococcus albus	50
Streptococcus type gamma and B. subtilis	44
Streptococcus type gamma and yeast	43
Streptococcus type gamma and Staphylococcus aureus	23
Streptococcus type gamma and L. acidophilus	16
Streptococcus type gamma and two or more other organisms	36
Total	212
Streptococcus type alpha and Staphylococcus albus	17
Streptococcus type alpha and type beta and B. subtilis	16
Streptococcus type alpha and type beta and yeast	13
Streptococcus type alpha and Staphylococcus aureus	2
Streptococcus type alpha and two or more other organisms	9
Total	57
Streptococcus type beta and yeast	3
Streptococcus type beta and L. acidophilus	2
Streptococcus type beta and B. subtilis	1
Streptococcus type beta and Staphylococcus aureus	1
Total	7
Staphylococcus albus and yeast	16
Staphylococcus albus and B. subtilis	4
Staphylococcus albus and L. acidophilus	2
Staphylococcus albus and B. subtilis and yeast	1
Total	23
Staphyloccus aureus and B. subtilis	14
Staphylococcus aureus and yeast	5
Staphylococcus aureus and L. acidophilus	3
Staphylococcus aureus and L. acidophilus and yeast	1
Total	23
L. acidophilus and yeast	4
L. acidophilus and B. subtilis	2
L. acidophilus and B. subtilis and yeast	2
Total	8
B. subtilis and yeast	7
Unidentified	18
Not recorded	19
Total	44

as well as a larger number of cases with single organisms than the "diffuse radiolucent" group.

Now let us consider the frequency with which organisms are found in root-canal cultures. In those cases giving only single organism cultures, the gamma, or non-hemolytic, streptococcus is the single organism most frequently found, being observed 158 times in the total of 388 cultures showing single organisms, or 41 per cent. The organism next most frequently found alone is *Staphylococcus albus,* eighty-six times, or 22 per cent.

Next in frequency among the single organism cultures is the alpha streptococcus, or *Streptococcus viridans,* which occurs in only 12 per cent, while *Staphylococcus aureus, Bacillus subtilis* and the yeast organisms follow, with the rates of 8, 7 and 4 per cent for their approximate frequency.

We have arranged the mixed cultures in their order of frequency and have found that the gamma streptococcus is one of the mixture in 212 instances out of 374, or 56 per cent. It is most frequently paired or in association with *Staphylococcus albus.* The next most frequently found organism in the mixed group is the alpha streptococcus, which occurs fifty-seven times in combinations, which do not include the gamma streptococcus already discussed. In all, it occurs only in 15 per cent of the mixed cultures. The beta streptococcus occurs among the single organism cultures only three times, or less than 1 per cent. It occurs thirty-nine times in combination with other organisms, which is 5 per cent of the total positive cultures. Certainly, the beta streptococcus appears to be of little significance in root-canal therapy as far as we can observe.

It is to be noted that we get a rather small proportion of single organism infections. The majority give mixed cultures. Of the pure cultures (single-organism infection), we find the non-hemolytic streptococcus to be the organism most

frequently found, with *Staphylococcus albus* next, and then the viridans type of streptococcus. This is in contrast to Burket's[6] findings, in which the predominant organism is *Streptococcus viridans.* Appleton[2] also finds that the great majority of streptococci in periapical infection are in the viridans group. In Burket's[6] studies, the material came from the necropsy table. In our case, the material came from persons in good health, except for the dental infection. It is possible that our differences may be due to the bacteriologic technic, the use of a 1 per cent dextrose broth and the surface streaking on horse blood-agar.

The numbers of other combinations of mixed organisms which do not include streptococci are comparatively few. *Staphylococcus albus* and the yeast organism together occur in sixteen instances, or in less than 2 per cent of the total positive cultures. *Staphylococcus aureus* and *Bacillus subtilis* occur fourteen times together.

An interesting observation that we have made is that the presence of *Lactobacillus acidophilus, Bacillus subtilis* and the yeast organism is apt to indicate some form of contamination. Where we have found that one or more of these organisms persist in a culture, a more careful sealing of the tooth under treatment, even to the placing of a band around the tooth, results in the elimination of these organisms. This would indicate that the presence of any or all of these organisms represents contamination and not pathogenicity.

We have also observed that while the gamma streptococcus occurs more frequently than the other organisms, it seems to have little persistence, as we usually find that it disappears in fewer treatments than the other organisms. The staphylococcus group is more resistant to treatment and hence is more persistent. The question often arises as to how many treatments are required to obtain negative results. It would appear that, in the majority of cases, four or five treatments are necessary. There is a real difference between the "circumscribed radiolucent" group and the "diffuse radiolucent" group. In the first group, four treatments were required for each case, while, in the second group, five or six treatments were necessary to obtain negative bacteriologic results. There is not a very significant difference in the number of treatments when we compare individual cases. In a large group of cases, however, the "diffuse radiolucent" group actually requires 40 per cent more visits for treatment than the "circumscribed radiolucent" group. In 265 cases, cultures totalling 2,202 were made, 762 being positive and 1,440 negative.

REPORT OF CASES

In illustration of the subject, reports of cases showing normal, circumscribed and diffuse radiolucency are presented, with the history, diagnosis, bacteriologic findings and follow-up results.

CASE 1.—*History.*—P. G., a boy, aged 16, in whom the maxillary left central incisor was involved in the original roentgenogram showed normal periapical structures.

Three years prior to admission, the patient fell on the pavement fracturing the incisal edge of the central incisor, but not exposing the pulp. The tooth became comfortable and gave no symptoms until two weeks before the patient appeared in the clinic. At that time, the tooth was sensitive to heat and to percussion.

Diagnosis.—Gangrene of the pulp was diagnosed.

Treatment.—October 25, 1937, routine treatment, as indicated under "Root Canal Therapy Procedure," steps 7 to 12, inclusive, was carried out. A culture yielded *Staphylococcus albus.* A roentgenogram was taken.

November 1, routine treatment was continued and cultures again yielded *Staphylococcus albus.*

November 4, routine treatment was continued and a culture yielded the alpha streptococcus.

November 8, there was routine treatment and a culture yielded *Staphyloccocus albus* and *Bacillus subtilis.*

November 12, after routine treatment, a culture was negative.

November 15, a measurement wire was employed in the canal. A culture was negative. A roentgenogram was made with the measurement wire in place.

November 19, the root was filled and two roentgenograms were taken.

Follow-Up.—February 8, 1939, roentgenograms were negative.

March 13, 1940, roentgenograms were negative.

CASE 2.—*History.*—M. C., a girl, aged 18, whose maxillary right lateral incisor was involved, had shown normal periapical structures in the original roentgenogram. The pulp was exposed in drilling in deep caries. There had been no symptoms prior to admission.

Diagnosis.—Chronic pulpitis was diagnosed.

Treatment.—May 3, 1937, routine treatment was carried out. Cultures were negative. One roentgenogram was taken.

May 10, treatment was routine and a culture was negative.

May 17, a measurement wire was employed and a roentgenogram was taken. A culture was negative.

May 19, the root was filled and two roentgenograms were taken.

Follow-Up.—January 21, 1938, roentgenograms were negative.

April 17, 1940, roentgenograms were negative.

CASE 3.—*History.*—G. M. G., a man, aged 30, whose mandibular right central and lateral incisors were involved, in the original roentgenogram showed areas of circumscribed radiolucency. Five years before admission to the clinic, the patient fell from a bicycle, striking the teeth, with no apparent injury to the crowns or roots. The teeth remained symptomless. A routine roentgenographic examination revealed the area of periapical involvement. The teeth were slightly discolored.

Diagnosis.—Gangrene of the pulp was diagnosed.

Treatment.—November 14, routine treatment was given. Cultures were negative. One roentgenogram was taken.

November 23, treatment was routine and cultures were negative.

December 2, treatment was routine and cultures were negative.

December 9, a measurement wire was employed and a roentgenogram was taken. Cultures were negative.

December 19, the root was filled and two roentgenograms were taken.

Follow-Up.—March 10, 1939, roentgenograms taken showed a "plus" condition.

November 29, 1939, roentgenograms showed a "plus" condition.

April 25, 1940, roentgenograms taken showed a "two-plus" condition.

CASE 4.—*History.*—C. T., a girl, aged 16, in whom the mandibular left central incisor was involved, in the original roentgenogram showed areas of circumscribed radiolucency apparently involving the apices of both incisors. The patient recalled a traumatic injury occurring sometime before, with increasing sensitivity to heat and percussion.

Diagnosis.—Clinical tests indicated that the pulp in the right incisor was vital and uninvolved. The left incisor had a gangrenous pulp.

Treatment.—October 19, 1936, routine treatment was given and cultures were negative. One roentgenogram was taken.

October 23 and 30, treatment was routine and cultures were negative.

November 6, a measurement wire was employed and a roentgenogram was taken. Cultures were negative.

November 16, the root filling was placed and two roentgenograms were taken.

Follow-Up.—May 5, 1937, roentgenograms taken showed a "two-plus" condition.

April 20, 1938, roentgenograms showed a "two-plus" condition.

March 29, 1939, roentgenograms showed a "two-plus" condition.

CASE 5.—*History.*—M. W., a girl, aged 18, whose maxillary left central incisor was involved, in the original roentgenogram showed an area of diffuse radiolucency. A Class III silicate filling had been placed one year before. Two weeks before admission, the tooth showed sensitivity to heat and percussion. It was opened for relief.

Diagnosis.—Gangrene of the pulp was diagnosed.

Treatment.—November 20, 1935, routine treatment was carried out and cultures yielded the alpha streptococcus. One roentgenogram was taken.

November 27, treatment was routine. Cultures yielded the alpha streptococcus.

December 4, 11 and 18, treatment was routine and cultures were negative.

January 8, 1936, a measurement wire was employed and a roentgenogram was taken. Cultures were negative.

January 16, the root was filled and three roentgenograms were taken.

Follow-Up.—March 24, 1937, roentgenograms taken showed a "plus" condition.

May 10, 1938, roentgenograms showed a "plus" condition.

February 29, 1940, roentgenograms showed a "plus" condition.

CASE 6.—*History.*—M. M., a woman, aged 24, whose maxillary left lateral incisor was involved, in the original roentgenogram showed an area of diffuse radiolucency. A Class III silicate filling placed four years before gave no symptoms until one week prior to the patient's coming to the clinic. At that time, the tooth was becoming increasingly sensitive to heat and percussion, and there was swelling of the face.

Diagnosis.—Acute alveolar abscess was diagnosed.

Treatment.—March 21, 1934, routine treatment was carried out. Cultures yielded the alpha streptococcus. One roentgenogram was taken.

March 28, treatment was routine. Cultures yielded the alpha streptococcus and the yeast organism.

April 11 and 23, treatment was routine and cultures were negative.

May 2, a measurement wire was employed and cultures were negative. A roentgenogram was taken.

May 16, the root was filled and two roentgenograms were taken.

Follow-Up.—October 15, 1934, a roentgenogram taken showed a "two-plus" condition.

May 15, 1936, roentgenograms showed a "two-plus" condition.

CASE 7.—*History.*—C. G., a woman, aged 35, in whom the maxillary right lateral incisor was involved, in the original roentgenogram showed an area of diffuse radiolucency. A Class III silicate filling had been placed two years before. Three weeks before admission to the clinic, the tooth had become increasingly sensitive to heat and percussion.

Diagnosis.—Gangrene of the pulp was diagnosed.

Treatment.—December 3, 1937, routine treatment was carried out. Cultures yielded *Staphylococcus albus* and the alpha streptococcus. One roentgenogram was taken.

December 10, treatment was routine and cultures yielded the staphylococcus and the alpha streptococcus.

December 20, treatment was routine and cultures yielded *Staphylococcus albus.*

January 5, 1938, treatment was routine and cultures were negative.

January 13, the measurement wire was employed and a roentgenogram was taken. Cultures were negative.

January 24, the root was filled and two roentgenograms were taken.

Follow-Up.—December 2, 1938, roentgenograms showed a "plus" condition.

March 13, 1940, roentgenograms showed a "plus" condition.

SUMMARY

We believe that root-canal therapy with bacteriologic control is not only a justifiable procedure, but also a necessary part of the dentist's armamentarium. Patients should be selected with care, all operations be carried out under strict asepsis and the progress of control of infection be determined by bacteriologic cultures.

This report concerns 265 completed cases that have been clinically and roentgenographically followed for from one to seven years from the time of placing the root-canal filling.

The results found at the follow-up examination were classified according to the roentgenographic appearance and comparisons of different groups were made.

Identification of the organisms to be found in the positive cultures was attempted. Nearly one-third (29 per cent) of the primary cultures were negative according to our routine aerobic method. The positive cultures were about equally divided between single organism and mixed infections.

Streptococci of the gamma type were found most frequently, followed by *Staphylococcus albus, Streptococcus viridans* and *Staphylococcus aureus.* Streptococci of the hemolytic type were

found infrequently and the course of these cases was not notably different from other types of single or mixed infections.

CONCLUSIONS

Successful repair with complete bone replacement occurred in nearly one-third of the 265 cases. The normal cases remained normal roentgenographically and showed no signs of retrogression.

The great majority of cases showed roentgenographic improvement.

Only 7 per cent of all the cases reported failed to show improvement and in only three cases could retrogression be demonstrated.

Root-canal therapy is a valuable dental therapeutic procedure. The cases designated as having "circumscribed radiolucency" showed less frequent infection and required fewer treatments than those having "diffuse radiolucency."

The end-results as shown by the follow-up records indicate that the "circumscribed radiolucent" group developed a much higher percentage of cases of complete bone regeneration.

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SODIUM CARBONATE IN THE TREATMENT OF VINCENT'S INFECTION

By S. Leonard Rosenthal, D.D.S., Philadelphia, Pa.

A RECENT experiment[1] demonstrated that the presence of sodium carbonate in the saliva of animals is an important factor in their immunity to oral Vincent's infection. Man lacks this constituent, the carbonate content being in the form of sodium bicarbonate, which has no such antibacterial action. It was further shown that topical applications of sodium carbonate could be used to arrest oral fusospirochetosis in man. Additional studies were necessary, however, to determine the extent of its usefulness and the best methods of application. These studies consisted of (1) studies *in vitro,* (2) studies on animals and (3) clinical results.

STUDIES IN VITRO

The Rideal-Walker, or phenol coefficient, test is not applicable to medicaments intended for oral use. The pH of the mouth, enzymes, fermentation and putrefaction products, various organic and inorganic compounds, detritus, oral flora and their products—in short, saliva and bacteria from a diseased human mouth—are necessary if oral conditions are to be approximated. It has been recently shown that chemical and physical reactions on surfaces differ from reactions in bulk.[2] Therefore, results in test tubes may not be so accurate as previously thought.

To meet these conditions, a test was devised using loss of motility as a basis of comparison,[3] in addition to inhibition of growth of the non-motile flora. This method (Fig. 1) also permits observation of the speed of action, power of penetration of débris, any undesirable coagulating effect or any specificity. Eagle[4] and Kolmer[5] have shown that loss of motility results in loss of pathogenicity for *Spirochaeta pallida.* Rosebury[6] has confirmed the results of motility tests on neoarsphenamine and sulfarsphenamine by animal experimentation. Clinical results have closely corresponded to previous evaluations[3] of numerous drugs by this method.

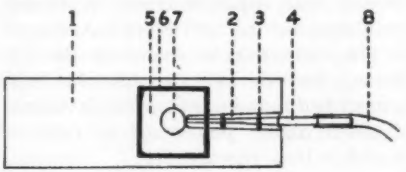

Fig. 1.—1. Glass slide. 2. Groove ground in slide. 3. Sticky wax. 4. Glass tube containing drug. 5. Cover glass. 6. Petrolatum. 7. Specimen of saliva and bacteria. 8. Rubber tubing. The apparatus is mounted on a dark-field microscope.

Aqueous solutions of sodium carbonate were subjected to this motility test. The results are summarized in the accompanying table.

Sodium carbonate solutions, 10 per cent or stronger, penetrate débris rapidly. They do not coagulate organic matter which would form a protective coagulum around bacterial cells, or otherwise limit antibacterial action. A 10 per cent aqueous solution has the same effect on motility as a saturated solution which is 1 part

Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Eighty-Second Annual Meeting of the American Dental Association, Cleveland, Ohio, September 10, 1940.

salt to 2.9 parts water. All motility is stopped instantly. Weak solutions are equally efficient against exposed organisms, but fail to penetrate débris. Bacteria protected by such material are therefore not subjected to the action of the solution. Ten per cent solutions inhibit growth of the non-motile flora; but in 1 per cent concentration, there is no such action.

STUDIES ON ANIMALS

Oral fusospirochetal infections in dogs were successfully treated by topical applications of sodium carbonate in 10 per cent aqueous solution. Application of this solution to the oral mucosa of animals did not show any escharotic action. I used a saturated solution as a daily mouthwash for three months. While stinging sensations sometimes ensued, there was never any deleterious action. A 10 per cent solution was less unpleasant to the taste and caused less discomfort.

CLINICAL RESULTS

Cases were classified as follows:

I. Superficial Vincent's infection.
   A. Acute.
      1. Membranous.
      2. Ulcerous.
   B. Subacute; painful edema of the tissues.
   C. Chronic; no subjective symptoms.
II. Deep Vincent's infection; infection of muscles, bone, etc.
III. Extra-oral Vincent's infection.

Only Class I cases have been treated thus far. Diagnosis was made from clinical signs and microscopic examination of oral smears.

A technic previously found satisfactory was used.[7] Débris was removed by a saline spray under pressure. In acute and subacute cases, the saliva was excluded by cotton rolls and a saliva ejector. The solution was applied beneath the free margin of the gingivae with a glass syringe and blunt curved platinum needle. Care was exercised to ensure that the solution reached the bottom of all pockets, covered every lesion and moistened the entire gingivae. The tissues were kept moist for ten minutes. The patient was dismissed with instructions for home care, which included use of a mouth wash of sodium carbonate. A 1 per cent solution was prescribed. No mechanical procedures were attempted until the acute symptoms had subsided (usually at the second visit). Medication was employed at every visit.

In chronic cases, scaling was begun at once, and was followed immediately by medication.

In order to eliminate the personal equation, twelve dentists were asked to report their experiences with sodium car-

RESULTS OF MOTILITY TESTS

Sodium Carbonate Solution		Spirochetes	Vibrios	Bacilli	Beef Infusion Broth	Agar	Anaerobic Blood-Agar
Saturated							
Per Cent	pH 11.43	Contact	Contact	Contact	0	0	0
10	pH 11	Contact	Contact	Contact	0	0	0
1	pH 9.5	Contact	Contact	Contact	+	+	+
0.1	pH 8.1	15	15	15	+	+	+

Motile organisms. { Figures represent the time required for loss of motility in minutes. Contact = instant loss of motility. 15 = organisms still motile at the end of fifteen minutes.

Non-motile organisms, fifteen minutes contact { 0 = no growth; + = growth

bonate, in addition to mine. One hundred forty-five cases have been treated by this method: eighty acute or subacute and sixty-five chronic. Twenty-five cases were treated with a saturated solution, the remainder with a 10 per cent solution. All terminated successfully.

Ten instances of sore tongue and gingivae were observed. In six of these, a saturated solution had been used. One patient complained of a burning tongue before treatment. Three cases had no visible lesions of the mucosa and seven showed definite desquamation. Investigation revealed that, in four instances, the mouthwash had been prepared from polyhydrous sodium carbonate ($Na_2CO_3.10H_2O$), which is markedly caustic either because of free OH ions due to ionization or to impurities contained therein. The U.S.P. form includes only one molecule of the water of crystallization—$Na_2CO_3.H_2O$. All discomfort disappeared in these cases within a week. The tissues healed and the infection was eliminated. The remaining 135 cases were without unpleasant sequelae.

The following case is typical.

A woman, aged 24, presented extensive ulceration of the hard palate and buccal gingivae. The pain was so intense that, for two days, she had limited her diet to "milk shakes," since heat as well as pressure was intolerable. The gingivae bled at a touch. A characteristic odor was present. The temperature was 99.8° F. Smears contained innumerable spirochetes and fusiform bacilli. Treatment afforded immediate relief. Solid food was eaten the following day. At the second visit (on the third day), scaling was begun without undue discomfort. The lesions were reduced in size and color. The odor had almost disappeared. The temperature was normal. After four visits, the tissues and smears appeared normal.

EVALUATION

A 10 per cent solution of sodium carbonate in water has no deleterious action on the hard or soft oral tissues, nor on metallic, vulcanite or resinous prostheses. It does not stain. Its speed of action, power of penetration, efficiency in the presence of organic and inorganic débris, efficiency at mouth temperature, low cost and clinical results recommend it. Tightly corked to prevent evaporation, solutions can be kept indefinitely without special care. The crystals are also easily stored.

Sodium carbonate has an unpleasant saline taste. A stinging sensation may follow its use, and some actual soreness of the tissues has been reported. In proper dilution, however, this is infrequent and transient. The solution is highly alkaline, and dilutions below 10 per cent reduce its efficiency. A 10 per cent solution is effective against both the motile and the non-motile flora. Action of the 1 per cent solution is principally on the motile bacteria; and must be supplemented by a second drug (such as iodine) the action of which is directed against the non-motile micro-organisms. In this manner, all bacteria can be controlled.

It may be concluded that a 10 per cent aqueous solution of sodium carbonate for topical application and a 1 per cent concentration for cautious home use have a definite value in the treatment of Vincent's infection.

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THE JOURNAL *of the*
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SCIENTIFIC DENTAL LITERATURE

AT the time when the editor entered dentistry, the mechanical aspect of dentistry had begun to monopolize the thought of most of the leaders of the profession, with the result that dentistry was rapidly coming to be considered almost entirely as a mechanical pursuit, with consequent loss of its biologic association with the healing art. It soon became evident, however, to the educators and leaders in dentistry that to pursue the mechanical motif to its logical finality would mean the abandonment of the scientific relationship that had received such an impetus from the notable work which Miller had done shortly before the opening of the twentieth century in establishing a biologic background for dentistry.

Miller, we believe, was among the first to recognize the desirability of establishing dentistry on a scientific foundation, and he was the first to dedicate a brilliant mentality to laying a biologic background for dentistry as an ancillary health service and as a branch of the healing art. Miller's contribution in 1891, "The Human Mouth as a Focus of Infection," was the first scientific effort to relate diseases of the mouth with diseases of the body, and although the mechanical motif remained in the

ascendancy for many years, Miller's work planted the seed from which was to emerge the scientific foundation and justification of the biologic relationship of dental practice. Miller's efforts were ably supplemented by those of Black and Williams, but the mechanical, the so-called practical, and the cosmetic and esthetic appeals were too evidently the prevailing motives in dentistry for even these pioneers to disregard them.

Most of the medical profession had become reconciled to relegation of the treatment of tooth and mouth conditions to the dentist; in fact, they were enthusiastic to the point of almost forgetting that the mouth and teeth were parts and organs of the human body. Paradoxical as it may seem, however, it remained for a few of the broader minds of medicine to awaken medicine, and dentistry too for that matter, to the important health relationship that the mouth and the teeth bear to bodily conditions. Billings, in this country, and Hunter, in England, were among the first to realize and to call attention to the serious import of mouth diseases as factors in bodily disease.

The mechanical aspect of dentistry had reached such a stage of perfection and had so completely subordinated every other phase of dentistry that the mouth and teeth almost came to be considered merely as a show place for expert mechanical ingenuity. Almost simultaneously, Hunter and Billings were aroused to the realization that a bridge is no stronger than its foundation and that dentistry had sacrificed its regard for the foundation in its efforts to perfect the visible superstructure.

The demand was for the practical as opposed to the scientific, to such an extent that in its development, dentistry tended dangerously toward a mechanical handicraft rather than the healing art. In the journalistic field, this trend seemed more apparent than in any other phase of practice. We were besieged with demands for more practical papers, with an utter disdain for so-called scientific articles, and this appeared to be the dominant thought in dental literature up to recent years. It became necessary for those who directed the literary product of dentistry to declare themselves as between the practical and the scientific types of literature. Fortunately, as we still see it, the desire for development as a biologic science prevailed and the destiny of dentistry was thereby determined. We are firm in the conviction that the dental objective is now clearly that of development from the biologic aspect and as an autonomous profession.

While our part in this momentous decision has been small, we have never veered from the contention for the scientific in dental literature.

There have been times when we were doubtful as to whether the scientific motif would prevail even with the educational forces on the scientific side; there has ever been a demand for the so-called practical and we have been sufficiently sympathetic to endeavor to meet this demand.

In the meantime, educational standards have been raised to scientific heights, and the standards of the literature are equally high. However, even now, the cry from some quarters is for more of the practical. We have long hoped that the educational standards would eliminate such demands and that, in later years, they would appear to be uncalled for; but no! The so-called practical still has quite a following—so much so that only recently we endeavored to ascertain the extent of such demand by means of a questionnaire to a cross-section of the profession in a number of representative states and districts.

We had two main motives in sending out the questionnaire: We wished to know, first, whether the present JOURNAL was meeting the desires, needs and demands of the profession, and, second, whether the type of literature was satisfactory.

The answers to the questionnaire gave ample justification for the belief that the intellectual, educational and professional status of dentistry has advanced materially with the advancement of educational standards and professional ideals. There are still those who clamor for the practical type of articles, but there are many more dental practitioners who appreciate the scientific article and who realize that the scientific is the only practical foundation upon which to build.

Miller's notable contribution referred to above definitely established the fact that an infected mouth is a constant menace to the health of the body; that the mouth is the natural habitat for a large variety of pathogenic organisms, and that it is the principal portal of disease-producing organisms to the body; but, more particularly, he furnished positive proof by laboratory experiment that certain mouth organisms are capable of setting up metastatic inflammatory foci in other parts of the body by transmission through the blood stream. As a result of the publication of Miller's discoveries, the whole complexion of dental practice and dental education underwent fundamental and revolutionary changes. Up to that time, the average dentist had drawn a distinct line of demarcation between what we designate as operative dentistry and prosthetic dentistry, and it was difficult for the purely mechanical dentist to realize that the products of his handicraft were even remotely related to the principles of physiology, pathology or anatomy. At present, however,

these elementary biologic considerations are controlling factors in the adaptation of every dental prosthetic fixture from a filling in a carious cavity to complete substitutes for the natural dentures.

Every student of dental history today realizes the epoch-making character of this pioneer work, yet it required more than a third of a century for these fundamental truths to bear their legitimate fruit.

Miller's early papers were regarded by the mass of the dental profession as the dreams of a scientist, of no value to the practical dental practitioner in the solution of his problems. The cry was that they were "impractical," and over the heads of the majority of dental readers. The demand for the so-called "practical" was so insistent that it required no small amount of editorial courage to adhere to a policy favorable to the publication of scientific articles in which the average reader could discern no particular application to his practical needs.

However, time has demonstrated the wisdom of the editorial policy of keeping the dental profession in touch with the latest advances in scientific research and the principles evolved by Miller are the working formulae of the present time.

The answers to the questionnaire amply justified the policy of publication of the results of scientific research work. A large percentage expressed definite preference for scientific communications—a further confirmation of our belief that the biologic approach to the problems of dentistry is the scientific one and the one that will determine the future of dentistry and guide it in its development.

There always has been and doubtless there will always be a certain percentage of readers who complain that scientific literature is "over their heads," but science is truth and intensely practical—and the trouble is with the "heads" and not with the truth, when it seems to overshoot its mark.

That the dental profession has taken proper precautions to assure the development of the future along scientific as well as "practical" lines is assured in the intensely concerned and serious manner in which the Council on Dental Education has undertaken its sponsorship and guidance of dental education. The future of dentistry is indeed bright, with a broadening horizon that constantly urges and demands the broadening of the scope of our knowledge.

DEATH OF DR. JOHN A. MARSHALL

IT is with exceeding sadness that we announce the death of Dr. John A. Marshall, of San Francisco, Calif., which occurred May 7. Dr. Marshall was Professor of Dental Pathology and Biochemistry at the University of California College of Dentistry, and a member of the Council on Dental Therapeutics of the American Dental Association. An obituary will appear in an early issue of THE JOURNAL.

DEATH OF DR. EDWARD T. TINKER

WE regretfully announce the death of Dr. Edward Tay Tinker, of Minneapolis, Minn., which occurred on May 8. An obituary will appear in a future issue of THE JOURNAL.

BIBLIOGRAPHICAL

Orientation in American Dentistry. Its History and Social-Professional Background. A Text-Workbook for Dental Students and Professional Health Workers

By ALFRED J. ASGIS, Sc.B., M.A., D.D.S., Ph.D., Assistant Professor of Oral Surgery and Lecturer on Orientation, New York University College of Dentistry; author of "Public Health Dentistry and Health Security," "Outline of Dental Socio-Economics," "Functional Dental Education," Etc. New York: Clinical Press, 33 West Forty-Second St. Price $2.50.

Vitamins, What They Are and How They Can Benefit You

By HENRY BORSOOK, Ph.D., M.B., Professor of Biochemistry, California Institute of Technology. Cloth. 193 pages. Price $2. New York: The Viking Press. 1940.

THIS book written for the layman contains general information on the vitamins and their place in the human dietary. The diseases associated with dietary deficiencies are briefly described and a few case histories concerning deficient diets are included. To render the work more practical, the author has included several chapters on the planning of meals for both children and adults to meet the vitamin requirements. A number of charts at the end of the book give the vitamin content of the most common foods. This book is well and interestingly written and presents authoritative information on the subject of vitamins for the general reader. It should prove useful to housewives and others concerned with the preparation of meals of full vitamin content.

The American and His Food

By RICHARD OSBORN CUMMINGS, Assistant Professor of History, Lawrence College. Cloth. 267 pages. Price $2.50. The University of Chicago Press. 1940.

THE interesting history of changing food habits and menus in relation to certain national developments is here presented. It is evident that the development of the canning processes and the extension of transportation facilities have had a marked influence on the dietaries of city families. In this class may also be placed the development of artificial refrigeration, which has served to make perishable foods universally available.

The discovery of certain nutritive elements, including the vitamins, and the effect of the first World War and the depression on the character of the American dietary are also interestingly described. This book should be of value to those interested in the effect of the impact of certain social changes on the physical welfare of human beings.

The Dental Story of the Dionne Quintuplets

A study and report of the dental conditions of the quintuplets to five years of age, by ARNOLD D. MASON, D.D.S., F.A.C.D., Dean, Faculty of Dentistry, University of Toronto. This interesting 24 page brochure tells the amazing story of the quintuplets' life from the moment they arrived in the unpainted frame Ontario farm house until they safely reached school age in their closely supervised modern nursery.

DOCTOR Mason gives a detailed description of the famous children's dental conditions. He devotes considerable space to their diet, prophylactic and dental care.

The booklet is illustrated with 118 photographs and charts including detailed models and x-ray pictures of each child's teeth. This very interesting book is excellent for the dentist's reception room table. It is published by the Ontario Dental Association, 86 Bloor Street, West, Toronto, Canada. Price $1.00 per copy.

Health Education

A report of the Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association with the cooperation of the Advisory Committees.

ITS 368 pages supply, from numerous sources, an authoritative compilation of technical statements and a consensus of professional opinions relative to health education.

Its twelve chapters supply information regarding the trends in health problems, the meaning of health and guiding the health education of children.

Chapter five, which deals with facts all teachers should know relating to the protection and improvement of child health, contains four excellent pages on mouth hygiene and child health. In chapter six, guiding the health education of children, four pages are devoted to dental hygiene.

Dr. Shirley H. Dwyer represented dentistry on the Revision Editorial Committee. Drs. Harvey Burkhart, Percy Howe and Lon W. Morrey served on the Technical Advisory Committee.

The book is very well written and the Committee has earnestly endeavored to present only the best in health education as a guide for teachers in elementary and secondary schools.

Copies may be had from the National Education Association of the United States, Washington, D. C. Price $1.50.

Chambers's Technical Dictionary; comprising terms used in Pure and Applied Science; Medicine; the Chief Manufacturing Industries; Engineering; Construction; the Mechanic Trades. With definitions by recognized authorities. Edited by C. F. TWENEY, Editor of "A Technological and Scientific Dictionary," Standard Books, etc., and L. E. HUGHES, A.C.G.I., D.I.C., B.Sc., Ph.D., A.M.I.E.E., A.M.I.R.E., M.A.S.A., Lecturer in Electrical Communication City and Guilds College, Imperial College of Science and Technology, London. New York: The Macmillan Company. 1940. Price $5.

THIS purely technical dictionary includes the technical terms that enable the man-on-the-street to understand what scientists and engineers have to say to each other.

Incidentally, the authors, in the preface, define a term that we have often wished defined, and one that is intimately concerned in the present dictionary effort—namely, a technical term. It is defined as "a word or expression which has special significance and value to a person learned or dexterous in a branch of knowledge relating to some particular human activity or to some particular aspect of nature." A dictionary of technical terms, therefore, should include, as far as its scope allows, all terms having such special significance and value. And this the present book does in an admirable manner.

Chambers's Technical Dictionary is a valuable reference work for words of special significance in the arts and sciences.

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President's Page

To the Members of the American Dental Association, Greetings:

THE following letter is an explanation of the origin and progress of the Preparedness Dental Program as it has been developed from its inception to the present time. So many versions having been outlined and so much having been written, and innumerable promises having been made regarding the future of the dentist and the dental program, all of which only confuses the issue, it seems to me that the obvious procedure is to outline the events so that our members will have a knowledge of the facts.

Early in the fall of 1939, your President, then President Elect, received a letter from Brig.-Gen. Leigh C. Fairbank stating that a near emergency existed in our nation and asking that names be suggested so that, in case an actual emergency confronted our government, a dental committee on national defense could be appointed without loss of time. A like request, I have been told, was sent to Dr. Merritt, who was at that time President.

Nothing further was heard regarding this matter until December of the same year, when a second letter was received stating that the President of the United States "had declared a state of emergency now existed," and the request was made that a dental defense committee be appointed.

Dr. Merritt immediately appointed the following as the American Dental Association Dental Preparedness Committee: L. M. Waugh, J. Ben Robinson, H. O. Lineberger, J. T. O'Rourke, C. G. Brooks, Edward H. Bruening and C. Willard Camalier, chairman.

In the interim, between the forming of the committee and the Annual Meeting in Cleveland, the time was mainly spent by the committee in forming state defense subcommittees and in studying the question at hand in order that an outlined program and recommendations would be ready for presentation to the Board of Trustees and the members of the House of Delegates. This program was presented in detail, with the result that, during the Cleveland meeting, the committee was reappointed, with the addition of Gerald D. Timmons, as secretary. At this time, also, $25,000 was appropriated, of which $5,000 was to be used as expense money for committee activities and $20,000 to make a questionnaire survey of the dentists of the United States.

During the Cleveland Meeting, the Chairman of the Preparedness Committee requested special permission for General Fairbank to address the members of the House of Delegates. The request was

granted. General Fairbank pledged his complete support, as well as that of his department, to dentistry, intimating that the dental program was entirely in his hands and that organized dentistry and the member dentist and the dental student would receive the utmost consideration.

To date, this assumption has not been justified. It is not that dentists believe they should receive preferred consideration because they are of a superior clay, but rather they believe that, because of their specialized skill, they are able to render the public a dental health service which is necessary to the health and happiness of the people. It is true that any dentist may become a first-class private, but can any private make a first-class dentist?

If our government wishes to effect real preparedness, it is as necessary to consider and preserve the health of the populace as it is necessary to consider and preserve the health of the armed forces. Without the health of its people, any nation is wofully handicapped at its very social, economic and military foundation.

Let us now consider the original plan as outlined for dental students and dental draftees. It was stated to the officials of the American Dental Association and to the members of organized dentistry from the lecture platform and in personal conversation with military officials that all dental students would receive deferred classification until after graduation and that all Association members would receive commissions upon induction into the Army.

How well these promises were kept is now history.

If it is expected of the profession of dentistry that the dentally unfit prospective draftee is to receive adequate dental service, in order that he may qualify for military service, it is the responsibility of those in high places in our government to make it mandatory that dentists not needed to serve the armed forces of our country be kept in private practice. Without this provision, our citizens will be deprived of the necessary dental health service.

Our profession of dentistry, and especially the American Dental Association, is eager to cooperate with the United States authorities in the defense program. In fact, dentistry would consider no sacrifice too great; but most certainly no profession can do its part if it is handicapped at its very source by the drafting of its members to become gun bearers in the front line of defense.

THE STATUS OF THE MURRAY DENTAL PREPAREDNESS BILL

During the last Congress, there was introduced by Senator Murray of Montana in the Senate of the United States a bill known as S. 4396, which later on was to become popularly known to the dental and medical professions as the Murray Bill.

This bill, in brief, proposed to make it mandatory that all dentists and physicians "shall in lieu of induction into the land or naval

forces of the United States" be given a commission as an officer in the "Medical Department Officers Reserve Corps." Later on, there was added a further provision that all medical and dental students and medical and dental teachers be exempt from service in the naval or military forces of the United States except in time of war.

The bill received the combined support of the medical and dental fraternity, but automatically died at the adjournment of Congress in December 1940.

Soon after the convening of the present Congress, Senator Murray introduced a similar bill, this time as Senate Bill S. 783. (February 6, 1941.)

During the Annual Meeting of the American Dental Association in Cleveland, all phases of the original Murray bill were most thoroughly discussed. The bill received the enthusiastic endorsement of the House of Delegates, the Board of Trustees and the Officers, as well as of the members of the Preparedness Committee. It was the consensus of opinion that, if necessary, every honest effort would be made to have the bill passed.

With this history of the bill fresh in their minds, the members of the Board of Trustees, during the February meeting of the Board, authorized the legislative and preparedness committees to lend every effort toward the passage of the second bill.

The bill, when originally proposed, was apparently not looked upon unfavorably by the army officials, but upon consideration of the second bill in committee, it was decided by the Army officials that the bill should not be passed, that the problem would be better handled by administrative action rather than by legislative action. If, in the end, dentistry and the public would be better served by administrative action rather than by legislation, no one could object; but, in the meantime, dental men were being inducted into the Army as privates, and no apparent effort was being made by the authorities to stop this injustice.

As the situation called for immediate action, on order of the President of the American Dental Association, the chairman of the Committee on Legislation contacted the state dental associations urging support of the Murray bill.

On March 18, a public hearing on this bill was held before the Senate Military Affairs Committee. At this hearing, a committee composed of representatives from the American Dental Association and the American Association of Dental Schools and the chairman of the Dental Preparedness Committee testified in behalf of the bill.

After due consideration by the Senate Committee, the bill was temporarily tabled. As this action left the impression that the future of the bill might be in question, to clarify the issue the following telegram was sent to Senator Murray:

Oakland, Calif., May 5, 1941

Senator Murray, Montana, Washington, D. C.:

Confusion exists regarding tabling S. 783. Appreciate wiring collect immediately disposition and position of bill.

WILFRED H. ROBINSON, President, American Dental Association.

Senator Murray's reply was as follows:

Washington, D. C., May 5, 1941

Dr. Wilfred H. Robinson, President American Dental Association

Re your telegram: S. 783 has not been acted upon by Committee on Military Affairs. Will be taken up again on Friday of this week for final disposition.

JAMES E. MURRAY.

Whether the bill will be favorably voted out of committee when reconsidered remains to be seen. (May 8.)

At the present time, the fate of the dentists who are about to be and who have already been inducted into the military service of the United States is in the hands of the Secretary of War. It is quite possible that before this letter appears in print, this situation will have been corrected. Let us sincerely hope so.

From a dental viewpoint, for the public, the situation is intolerable. One cannot believe the War Department is again going to make the mistake that was made during the last World War in misapplying the ability of those in the health professions.

In conclusion, may I assure the members of our Association that the officials of the American Dental Association are using every effort and all possible influence to protect the interests of the public and the profession.

Wilfred H. Robinson.

COMMITTEE ON DENTAL PREPAREDNESS

THE Committee on Dental Preparedness is pleased to announce that the problem of the dentist drafted in a non-professional capacity and the deferment of competent dental students seems to have been satisfactorily adjusted. The committee calls the attention of the profession to the following official release bearing on deferment of dental students and practitioners issued under date of May 12, 1941, by National Headquarters of Selective Service:

NATIONAL HEADQUARTERS
SELECTIVE SERVICE SYSTEM
Washington, D. C.

May 12, 1941.

MEMORANDUM TO ALL STATE DIRECTORS (I-99)

SUBJECT: SUPPLEMENT TO MEMO (I-62): OCCUPATIONAL DEFERMENT OF DENTISTS AND DENTAL STUDENTS (III)

Reports from the Office of Production Management and from the War Department to the Deputy Director of Selective Service demonstrate that the dental profession constitutes an activity essential to the national health, safety and interest, and that a serious interruption or delay therein is likely to impede the national defense program. The substance of these reports is broken down in detail for the information of local Selective Service agencies as follows:

I. DENTISTS

A. Supply.—At present, it is estimated that there are approximately 70,000 practicing dentists in the country.

B. Demand.—The national defense program as now outlined requires 5,220 dentists for the Army and 100 additional dentists each year for the Navy. These requirements and the increase demands from sources other than the armed forces represent a reduction of at least 5 per cent in the number of dentists available for service in civilian life. Over the past few years, there has been an actual decrease in the number of dentists in this country—this in spite of a growing population. It is estimated today that about 22 per cent of the United States population receives dental care. The effect of this situation is reflected in data which show that substandard teeth and oral diseases constitute the greatest single cause for physical rejection of selectees. These rejections not only represent a loss of manpower available for military service, but also may be taken as indicating an impaired level of effectiveness in the performance of civilian defense work. Any further reduction of dental facilities may be expected further to aggravate the situation.

C. Shortage.—Although the War Department reports that there is now a sufficient number of officers in the Dental Corps Reserve to meet their current requirements, from the foregoing it is apparent that there is an over-all and increasing national shortage of dentists. Further, since the supply is not distributed in accordance with the population, there are present shortages in some local board areas. On the other hand, there are present surpluses in other local board areas. However, any such surpluses may be substantially reduced and even wiped out entirely by reason of the requirements of the armed forces and the increased civilian requirements as above indicated.

D. Policy and Procedure.—The local board has the problem of deciding, subject to appeal, whether an individual dentist is so necessary to a community that he should be deferred from training and service under the provisions of paragraphs 350-353 of the regulations.

This problem should be approached with a clear appreciation of the over-all national shortage, and with the health needs of the community clearly in mind. In classifying, the local board should give full weight to the fact that the Dental Reserve Corps is at present of sufficient strength to fill current Army needs. If, nevertheless, the local board determines that he should not be deferred, and he is finally placed in Class I A, it should call his attention to the following War Department instructions:

Individuals who are qualified for appointment in the Dental Corps Reserve and who have been inducted under the provisions of the Selective Training and Service Act of 1940 should be encouraged to apply for appointment in order that they may serve in a professional capacity. Individuals accepted for appointment will be discharged and ordered to extended active duty for a period of twelve consecutive months.

II. DENTAL STUDENTS

A. Supply, Demand and Shortage.—The accompanying tabulation is an estimate of the output of the dental colleges, compared with the dental needs of the country if the present ratio of dentists to population is to be maintained.

OUTPUT OF COLLEGES AS COMPARED WITH DENTAL NEEDS OF THE COUNTRY

	1941	1942	1943	1944
Number of dental graduates necessary to maintain present ratio of dentists to population	2,250	2,250	2,250	2,250
Estimated number of dental graduates	1,150	1,809	1,809	1,809
Shortages per year	750	441	441	441

The shortage over a four-year period is 2,073. There are no replacements for dental students who are withdrawn from school. Consequently, if the supply of dental students who are to be graduated into the dental profession is reduced through their induction to serve in a non-professional capacity, an increasing reduction of dentists available for military service, as well as an aggravation of the increasing over-all national shortage, will result.

B. Policy and Procedure.—It is of paramount importance that the supply be not only maintained, but also encouraged to grow, and that no student who gives reasonable promise of becoming a qualified dentist be called to military service before attaining that status. Local boards should remember that a deferment is not an exemption and that the obligation and liability for military service remain upon its expiration. The procedure governing deferment of dental students is that prescribed by a memorandum to all state directors (I-62) of April 22, 1941 (See also Bull. 10, American Council on Education, attached thereto, and night letter to all state directors, April 30, 1941.)

LEWIS B. HERSHEY,
Deputy Director.

COMMISSIONS FOR QUALIFIED DENTAL PRACTITIONERS

In accordance with the radiogram of the Adjutant General, dated May 5, to commanding generals of all field armies *et al.*, dentists who have been inducted into the service in a non-professional capacity should contact their immediate commanders requesting an opportunity to file applications for commissions. Further details of procedures to be followed in filing applications and the subsequent handling thereof by the War Department will shortly be issued by that department.

Dentists who have not been actually inducted or who are now classified in Class 1 A should request deferment under the provisions of General Hershey's telegram of April 30 and the statement of dental needs memorandum to all state directors (1-99), dated March 12, as noted above. It must be understood that the local board passes finally upon each individual case on the basis of the military and civil needs of the nation, and while the announcements above mentioned cannot be mandatory on the board it will undoubtedly give proper weight to the statement of needs and the emphasis placed on the "over-all national shortage of dentists, dental students, etc." If the individual has been inducted into the service in a non-professional capacity, he should apply at once for a commission. From that point on, the War Department will consider the qualifications of the applicant in connection with the granting of a commission.

DEFERMENT OF DENTAL STUDENTS

The statements embodied in the last two paragraphs of General Hershey's communication of May 12 are specific and are believed by this committee to be eminently fair. It seems difficult to imagine that any local board in the United States, with this entire communication before it, would refuse to give deferment to a dental student "who gives reasonable promise of becoming a qualified dentist." The statement under B reading "It is of paramount importance that the supply be not only maintained but also encouraged to grow" should be most encouraging to the profession and especially to the students now enrolled and to be enrolled in our dental schools. The publicity on the subject carried by the associated press and other agencies on May 18 was valuable and should be extended by state and local societies. When the student body has been finally classified as of July 1, it would be most valuable to the committee to receive this information for use for further action if later deemed necessary.

The committee is of the opinion that the War Department and the Selective Service System, under these regulations, have recognized very definitely the importance of dentistry as an essential factor in providing for a national emergency, both military and civil, and whatever develops from this point on will be regarded by the government in the light of this conclusion. It is felt that all members of the profession should enter wholeheartedly into the spirit of the Selective Service Program and its regulations in an effort to assure maximum results in a program of national defense. If experience should indicate that further revisions of the dental program are necessary, recommendations can be made through the Committee on Dental Preparedness to proper governmental authorities who, as in the past, will doubtless give any proposal careful and sympathetic consideration.

While this statement is submitted by the Committee on Dental Preparedness and all had a part in bringing its efforts to a successful conclusion, the chairman desires to express appreciation for the excellent service rendered by members of the Dental Advisory Committee to Selective Service not members of the preparedness committee; namely, Sterling V. Mead and William Hodgkin; to Leroy M. S. Miner, chairman of the Preparedness Committee of the American Association of Dental Schools, Harlan H. Horner, secretary of the Council on Dental Education, and those members of the preparedness committee near Washington and those vitally concerned with the school problem; i.e., J. Ben Robinson, John T. O'Rourke and Gerald D. Timmons.

We are grateful also to Surgeon General Magee, General Love, and Brig.-Gen. L. C. Fairbank for their sympathetic attitude and untiring efforts in

these matters. The committee further appreciates the cooperation and assistance given it by General Hershey, director of Selective Service, and by Colonel Rowntree, Colonel Eanes, Colonel Baggs, Major Bier and Lieutenant Folk, of the Medical Division, Selective Service Headquarters.

The committee is pleased to report that Lieut. Com. C. Raymond Wells has been prevailed upon by Selective Service Headquarters to accept an assignment as dental officer in the medical division under the direction of Colonel Rowntree. Dr. Wells is favorably known throughout the profession, especially in his services to the American Dental Association as chairman of the Judicial Council. He not only will prove a valuable addition to the office of Selective Service, but will also represent dentistry there in a highly satisfactory manner. It is believed that Dr. Wells will be at his post prior to June 1.

C. WILLARD CAMALIER, *Chairman,*
Committee on Dental Preparedness.

COMMITTEE ON LEGISLATION

MEMORANDA recently released by the Selective Service Administration and War Department assure us that, to a considerable degree, dentistry has attained objectives long sought by the American Dental Association to insure the conservation of the nation's dental resources and the utilization, in a professional capacity only, of drafted qualified dental graduates.

Over a period of many months, during which time many conferences were held with representatives of the Selective Service Administration and War Department, the American Dental Association patiently endeavored to secure, by administrative action, deferment of students and commissions for qualified graduates, with, until very recently, no apparent results other than assurances and regularly repeated postponement of official action.

Recognizing finally the immediate need of focusing the attention of the government agencies on this problem, the American Dental Association endorsed Bill S. 783, introduced by Senator James E. Murray of Montana and that sought, by act of Congress, to attain these objectives for dentistry and medicine, and the Committee on Dental Legislation, following a meeting in Washington of its executive members, began an intensive effort to secure congressional support for this measure.

The bill, as originally written, had certain provisions not entirely acceptable to medicine, although the dental profession was in general satisfied with the sections relating to dentistry, particularly since it was understood that changes in the bill to remove any objectionable phrasing would doubtless be made by the Senate Military Affairs Committee, to which S. 783 was referred for consideration.

Following a public hearing and several executive committee hearings on the bill, newspaper editorial comment began to appear in support of the conservation of dental and medical resources for the benefit of civilian and armed forces, and favorable interest in the bill was expressed by many members of Congress.

The bill was opposed vigorously by the War Department and the Selective Service Administration, although it was becoming apparent that the Selective Service Act must be amended. However, it would appear that the government agencies were not yet ready to introduce legislation for that purpose. Insistent

that all necessary objectives could be attained by administrative action, without the necessity for mandatory legislation, official action was finally taken that seemingly corrects a condition of affairs that was not in the interest of civilians, army or navy and not in keeping with national preparedness plans that contemplated the utilization of the nation's resources with a minimum of waste of either manpower or of highly trained technical and professional skill.

With the seeming solution of this problem, the status of the Murray Bill is that of pending legislation and it will be held in committee until it is determined how effectively the Selective Service Administration is able to make deferments that relate to dentistry and medicine.

Senator Murray and his associates in Congress, to whom Dentistry is indebted, are of the opinion that publicity given this proposed legislation was responsible for finally centering the attention of the army and the Selective Service Administration on this problem and bringing about official action, which the officials of the American Dental Asosciation and in particular its Committee on Dental Preparedness had vigorously urged for many months.

A. P. PATTERSON, *Chairman,*
STERLING V. MEAD, *Vice Chairman,*
Committee on Legislation,
American Dental Association.

FLORIDA ENACTS NEW DENTAL LAW

ON May 2 the Governor of Florida signed Senate Bill 92, which provides for a complete revision of the state dental practice act. The bill was sponsored by the Florida State Dental Society and passed by the legislature with a minimum of changes, none of which apepar to have been detrimental to the purpose of the bill.

The new law prohibits any one from advertising the sale or offer of sale of dentures or dental appliances directly to the public.

The definition of what constitutes the practice of dentistry is rewritten as well as many other portions of the act. The restrictions on advertising by dentists are made slightly more extensive, although the previous act was fairly adequate in this respect. The provisions regulating the practice of dental hygiene are also revised.

The enactment of this bill constitutes the second major legislative development with regard to dentistry this year. Several months ago the legislature of Nevada passed a bill which provided amendments designed to improve the effectiveness of their law, particularly in respect to dental advertising.

BUREAU OF PUBLIC RELATIONS

DENTISTRY AND THE MAGAZINE EDITOR

"NEWSPAPER and magazine editors are not interested in dentistry. Oh, a news editor might—once in a blue moon—print a picture of a good looking dental assistant in short skirts, but a magazine editor—well, a magazine editor is simply allergic to dental articles." Thus laments the publicity-seeking dentist. And strange as it may seem, the American Dental Association does have a few publicity-minded members, who are often more interested in the insertion of an article in the press than they are in the insertion of an inlay in a tooth.

News editors *are* interested in dentistry whenever dentistry is news. Witness the stories entitled "rejection of draftees because of dental conditions"; "the conscription of dentists for line service" and "girls' teeth are more susceptible to cavities and other dental disorders than those of boys," which have been carried recently by the leading news services.

But, after all, newspaper articles may be considered "plebeian." Rather, we would refer to magazines and magazine editors, being, as they are, more "intellectual."

"Dental Cripples," by Edmund M. Johnston, D.D.S., in the May issue of *Health,* explains how "Buck" Jones got that way. Parents reading this article will learn much about crooked teeth, their cause and correction.

"They threw me out, Doc! Me! Can you imagine—Me!" C. Ward Crampton, M.D., in the February *Boys' Life,* tells the story of dashing Dink Jackson, who was turned down by the army because of bad teeth.

Don Chalmers Lyons, D.D.S., explains to May *Hygeia* readers "Why Teeth Decay" and does it in such a well-written and well-illustrated article that it will draw and hold the attention of every parent who sees it. And speaking of parents, the January issue of the *California Parent-Teacher Magazine* contained Dave McLean's matchless article "Outgrowing the Horse and Buggy Age." "In those days the clack clack of hoofs proclaimed the passing of the horse car—a few daring boys played hooky and—folks took teeth as they came." Parents, especially parents of the older type, and grandparents who long ago wrote in their copy books, "Habits begin as cobwebs, but end as iron bands" must have enjoyed this article.

Again speaking of parents, the March issue of the *National Parent-Teacher Magazine* contains Lon Morrey's "I Talk to My Son About Teeth," written for parents of preschool children, about a real preschool boy and his teeth.

R. Reed Smith, D.D.S., has by far the best batting average this spring, with "Your Teeth Can Warp Your Life" in the January issue of *Your Life;* "Better Teeth for Your Children," in the March *You and Your Child,* and "Teething in the Forties," in *Fathers' Magazine* for May.

The last title reminds us of Ben Gaylord Hauser's "From First Teeth to False Teeth," in *Health Culture Magazine* for March. "Dentistry," says Hauser, "is a civilized profession which has grown to be necessary because of our dietetic sins—only a few years ago a set of 'store' teeth at forty was as inevitable as the proverbial death and taxes. Today false teeth are only a sign of ignorance of what goes to make good first teeth." It contains some highly controversial statements, but it does make the reader want

to go to his dentist to check his newly found facts.

Fred D. Miller, in a lengthy and interesting article in May *Esquire*, gives the kids in college, eating their fill of candy, sundaes and hot dogs, something to think about. "Dentists," says Fred, "are necessary and American dentistry is far superior to any other in the world. Even so, nature makes better teeth than dentists make, and has been doing it for eons.... Man is usually the aggressive "culprit" who brings dental caries upon himself and not a helpless victim of it... what you have in your mouth is important. But what you put in your mouth is more important by far.... Those who disobey nature's dietary laws pay through the teeth." May *Esquire* may still be found on the newsstand. Get a copy; you'll find Fred's article worth it.

And then, for women of all ages, *Glamour* for April carried Harold J. Leonard's excellent article, illustrated with a full page photograph of charming Norma Shearer. Of course, all women cannot be so attractive as Miss Shearer, but most women by following Dr. Leonard's advice can greatly improve their appearance.

Yes, indeed — news editors *are* interested in dental news and magazine editors *are* interested in well-written, constructive articles on dentistry.

TWO YEARS' DENTAL SCHOOL WORK IN BRITISH NORTH BORNEO; RELATION OF DIET TO DENTAL CARIES AMONG NATIVES

By F. LABAND, M.D., D.M.D., Sandakan, British North Borneo

BRITISH North Borneo, one of the four states of Borneo, forms the northern portion of the Island and is governed by the North Borneo (chartered) Company. It is about the same size as Ireland and has approximately 302,174 inhabitants, 242,159 of them, natives of Malayan stock, the only ones with which we are concerned in this article.

The country is geographically divided into two different regions, the well-populated coastal belt and the hilly and mountainous interior, which is sparsely populated and has few of the benefits of civilization, such as sanitary facilities, electric light and a controlled water supply. The natives in the heart of the interior are hunting people and frequently move their villages with shifting cultivation. In parts that are more accessible, they are settled as peasants and grow everything necessary for their own needs. They have little opportunity to sell their goods owing to lack of transportation. In the coastal belt, they are peasants and fishermen, and are better off than those living in the interior as they are able to transport and market their goods.

The country is divided into the East Coast Residency and the West Coast Residency for purposes of administration. On the West Coast, a railway of 120 miles leads from Jesselton, the port and center of the West Coast Residency, inland through large rubber estates. From the terminus of the line, a road of another 30 miles leads to Keningau in the interior. From here on, well-kept bridle paths are the only means of reaching the different villages.

The difficulty of maintaining a systematic and economical medical and

dental service lies in the rather slow communications. The advantage from the research point of view is that the natives are in their original state and have never had any dental treatment. In some parts of the country, the natives have never seen a dentist. Their standard of living is primitive. Rice is the basis of the diet (unpolished up-country; polished in towns). Added to that are meat (buffalo, chicken, duck, pig, game), dried and salted fish, curry and home-grown vegetables and fruit. The sugar used is generally crude and the habit of chewing sugarcane is universal. I mention the staple diet beforehand, as I must come back to it later when we compare the conditions in towns and villages.

Fig. 1.—Typical Malay boy. In the background are storehouses for rice.

Schools have been established by the government. The language used and taught is Malay. Schools were first opened in towns, where educational work can be supervised more easily, and were then opened all over the country. When establishment of a school seems advisable, the village people build an Atap schoolhouse (i.e., a wooden understructure and palm leaves) and the government provides the teacher and the teaching material. The more interest the parents take in the education of their children, the more support they receive from the government, until finally the government builds a wooden schoolhouse and quarters for the teachers; supplies school implements, and even furnishes plots of land for school gardens, where the children learn the basis of modern and more effective agriculture. The schools that I visited vary in attendance from twenty to 120 children. Girls go to school only in towns. The children are examined regularly by the government doctor and receive free treatment if necessary. Their teeth are examined once a year.

Up to the present time, the greatest part of the population are heathen and they marry only in their own tribes. Mohammedanism, which is spreading rather rapidly, opens the way for intermarriage with other Mohammedan tribes, Indians and Javanese. Under the present conditions, we have an opportunity to investigate the anthropologic and health conditions of the aborigine tribes in their original state. In my opinion, in another twenty years, Mohammedanism and the development of roads will result in a mixture of tribes. Then the people will consume much more imported food. In short, they will

Fig. 2.—Malay village boy with well-formed maxillary arch.

show the conditions that are found in every other eastern country.

I began with the treatment of children in towns, and worked along the railway line to Keningau, which I made my headquarters for the treatment of the Keningau and the Binkor school children.

In 1938 and 1939, the pupils of nine schools were examined and treated in this way, seven of them twice. Naturally, the equipment used was simpler than in an established permanent surgery, as the outfit had to be packed up more or less every second day and transported by boat, railway or bus, and finally for short distances by carriers. A collapsible dental chair, a foot engine, a sterilizer with spirit lamp, the normal number of hand instruments, procaine in tablets, syringes and filling material comprised the equipment. For examination, bamboo spatulas and explorers were used.

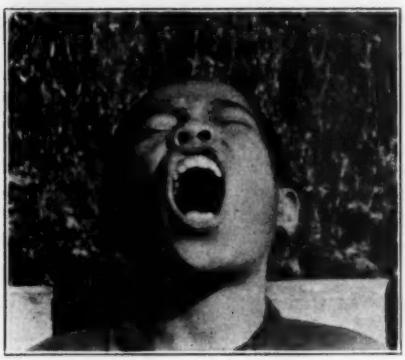

Fig. 3.—Malay town boy with healthy teeth, but narrower maxillary arch. (Compare Fig. 2.)

The usual procedure was as follows: I visited a school and gave the teacher some dental hygiene pamphlets written in romanized Malay. The text of these pamphlets was, incidentally, taken from an American schoolbook that I found in use among the American missions here. The teacher delivered a short talk to the children, telling them that they would get treatment, and read the seven paragraphs about dental hygiene to them.

Then I established my surgery, either in a schoolhouse or in another available place, such as a government resthouse, a dispensary or a courthouse in the vicinity. I examined the children, and my assistant noted the details and needs for treatment for every child. The treatment followed as in any other clinic. The children are on the average very trusting and confident, and there were very few difficulties in treatment, especially if I allowed them, as I generally did, to watch the treatment of the other patients.

Fig. 4.—Wooden schoolhouse near town.

As manufactured toothbrushes are too expensive for them, I tried to introduce a toothbrush that the children can make for themselves out of a soft woodstick into which a beaten piece of coconut husk is inserted, making quite good bristles. I obtained the model from the Dutch Colonial Dental Service. Containers for the toothbrushes are made of bamboo, with a cover of the same material with air holes cut in it. Every morning the children clean their teeth, under the supervision of the teacher, and they are instructed to clean them again in the evening.

As the main items of this article are the dental conditions, the figures on dental caries are given in Table 1.

Among the teeth affected by caries, the first lower molars show the highest figures, 45 per cent; the second lower molars the next (19.87 per cent); the first upper molars, 13.72 per cent, and the second upper molars, 2.55 per cent. The rest of 18.86 per cent is distributed among the other teeth, none showing more than 2 per cent.

accidental observations impossible. We therefore divided the patients into children examined once and children examined twice. The children once examined numbered 614 and 57.16 per cent were found free of caries. The children twice examined numbered 420 and 43.57 per cent were free of caries, (Table 2).

These figures show that: 1. Among the children up country, 52.07 per cent are free of caries for two years, and I think

TABLE 1.—DATA ON DENTAL CARIES

	Year*	Children Examined	Children Treated Number	Children Treated Per Cent	Fillings Amalgam	Fillings Cement	Fillings Gutta-percha	Extractions	
Sandakan	1938	120	64	53.30	84	14	12	55	Towns
Sandakan	1939	120	58	48.33	79	3	1	25	
Jesselton	1938	99	53	53.33	60	5	—	67	
Jesselton	1939	74	33	51.23	62	3	2	8	
Tuaran	1938	72	32	44.40	45	—	3	20	Villages
Tuaran	1939	55	23	41.82	29	—	—	3	
Papar	1938	173	60	34.68	125	3	3	29	
Papar	1939	137	42	30.65	60	—	—	10	
Bangawan	1938	81	24	29.62	46	—	3	4	
Bangawan	1939	55	16	29.09	22	—	—	1	
Keningau	1938	74	19	25.60	26	2	—	8	
Keningau	1939	57	21	36.84	48	3	—	12	
Binkor	1938	120	40	33.33	43	4	—	14	
Binkor	1939	97	34	37.11	59	—	—	3	
Visited once only:									
Kinarut	1938	40	13	32.50	20	—	—	10	
Tenom	1939	27	9	33.33	15	2	—	7	

*Comparing the figures obtained, 1938 and 1939, we find that the difference in percentage of children who needed treatment is really small. In the first year, 39.20 per cent showed dental caries and were treated; in the second year 38.51 per cent. This gives an average of 38.85 per cent. This figure is extremely low as compared with those from any European country or the United States. Great Britain, for instance, has an average of 95 per cent and the United States about the same.

The main difference found in the frequency of dental caries is between children in the towns and the village children. The definitely better dental conditions up country can easily be proved to be facts and not chance results, as a certain number of children have acted as controls over a period of two years. Their status describes the actual conditions. They give the alternations over a two-year period and make

that we can call them caries-immune. The percentage in towns is more than 50 per cent lower (24.61 per cent). 2. The number of children who develop new decay in a year's time is considerably higher in town than up country. (39.23 per cent in towns, 28.95 per cent up country.)

These differences appear to be rather considerable in a country where one is under the impression that the conditions

among the natives are more or less the same in all places. This is, however, not the case, and it is necessary to study the known conditions that could influence the development of teeth or cause decay. These have to be divided into the external and the internal, the soil and the seed. The seed, which means race and inherited qualities, are actually the same in towns and villages. The town population is not specially selected. Therefore, external conditions, environment and diets have to be considered.

TABLE 2.—COMPARISON OF CONDITIONS IN TOWNS AND VILLAGES*

	Number	Per Cent
Towns (Sandakan and Jesselton)		
Boys, twice examined	130	
Twice free of caries	32	24.61
Needed treatment twice	33	25.38
First time treated, second time free of caries	47	36.15
First time free of caries, second time treated	18	13.85
Villages		
Boys, twice examined	290	
Twice free of caries	151	52.07
Needed treatment twice	51	17.58
First time treated, second time free of caries	55	18.98
First time free of caries, second time treated	33	11.37

*Based on two years' figures (children twice examined.)

The main point in environment is sunshine, the effect of ultraviolet irradiation of the skin and the food. It can, I suppose, be taken for granted that in this country of ample sunshine, it is the same in towns and villages. That leaves only the diet for consideration. The amount of proteins, such as meat, fish, eggs and milk, in the native food is relatively small and very similar in towns and villages. In the interior, dried fish is substituted for the fresh fish of the coastal belt. The bulk of the food is rice, supplemented by vegetables and fruit. I inquired carefully into this subject, and it seems to me that, in this connection, we find the outstanding difference between town and village. In town, polished rice is eaten almost entirely, with only a small quantity of fruit and vegetables added because they are expensive. The sugar used is often refined and the milk for children is generally tinned, even sweetened. Altogether, the food for the most part is refined carbohydrates, which are bound to be deficient in vitamins B and E, crude fibers, calcium, phosphorus, iron and copper. The native up country plants his own rice and eats it unpolished. Sugar cane is the normal sweet-supply of children and fruits and vegetables are plentiful. Refined sugar, manufactured sweets and cakes, as eaten in towns, are practically unknown. In addition, all kinds of jungle fruits are eaten.

As we have now seen, the decisive difference in the food in towns and in villages lies in the carbohydrates, and among the carbohydrates mainly in the different kinds of rice, eaten polished in towns, unpolished up country. The analysis of rice gives very convincing figures. (Table 3.)

The conditions found here are very similar to those described by Weston A. Price in the natives of Peru. The change from homegrown food to the food of modern commerce seems definitely to increase the disposition to dental caries, which may be looked upon as a deficiency disease.

Let us compare our findings with cases of beriberi, a rather common deficiency disease in this country. An average case would take the following course: A pregnant woman, living in town, eats commercial and therefore deficient food, but shows no definite sign of illness. In due time, the child is born and it is breast-fed. After a few days, it develops an acute attack of beriberi, but can be saved by a vitamin B injection; which shows (1) that during the prenatal pe-

riod, the supply of vitamin B was not sufficient and (2) the mother's milk was also deficient in vitamin B. The mother, actually harboring a latent beriberi, may or may not show symptoms, but the effect of malnutrition is seen in the child. The mechanism of metabolism which influences the development of tooth germs and teeth seems to me very similar. We know that the diet of the town population is not only short in vitamin B complex and vitamin E, but also in minerals. The parents, who often are born and brought up in villages, had their bodies adults so much as it deprives the children of the building material for healthy teeth. It can therefore be concluded that the condition of dental caries among town children is the exact parallel of acute beriberi among infants.

There is another and anatomic alteration to be observed between natives from up country and townspeople. The natives up country have well developed, round and broad maxillary arches. The teeth have ample space and are in excellent position. Third molars appear early some time between the twelfth and the

TABLE 3.—ANALYSIS OF RICE

	Minerals Per Cent	Fiber Per Cent	Carbohydrates Per Cent
Polished rice	0.8	0.4	80.3
Rice-polishings	5.8	4.3	41.4

	Water	Ash	Chlorine	Phosphorus Pentoxide	Calcium Oxide
Polished rice	12.2	0.8	0.048	0.380	0.014
Rice-polishings	8.15	5.9	—	3.35	0.580

	Magnesium	Sodium	Potassium Oxide	Sulfate	Iron
Polished rice	0.036	0.022	0.074	0.038	0.00102
Rice-polishings	1.15	0.056	0.72	0.025	0.026

	Copper	Manganese	Iodine
Polished rice	1.3	13.8	2.6
Rice-polishings	0.7	7.3	4.13

Vitamin B complex: Husked rice, 10; white rice, 0.*
Vitamin A: Brown rice, 75.
Vitamin B: Polished rice, 7; brown rice, 55.†

*Rosedale, J. L.: Chemical Analysis of Malayan Foods.
†Eddy and Dalldorf.

built up on home-grown, unrefined food, rich in vitamins and minerals. Their teeth are in good condition. Now that they are living in town and on town food, we can call them borderline cases, cases of latent deficiency disease without severe symptoms. But the children, born and brought up under town conditions, show the effect of poor diet. During the prenatal period, and during the following years of growth, at the time when the teeth are developed and built up, they suffer from a continual lack of vitamins and minerals. This lack does not affect eighteenth year, and function well. The natives in town develop narrower and higher maxillae. The teeth are overcrowded and show irregularities in position, with narrow interspaces, all factors in an increase in dental caries. The general effect is clearly shown in the foregoing figures of dental caries among the school children.

GENERAL OBSERVATIONS

On the average, it could be stated that the form of the children's teeth is very good, with well-shaped crowns and

strong roots. They are slightly larger than the teeth of Europeans. Among 291 children, twenty-one had from one to four well-developed third molars between 13 and 17 years. Of the adults 99 per cent have all their third molars in good anatomic position.

Abrasions are very often found, even among children, as they are forced to chew more natural, unrefined and harder, food than we do. I frequently saw men between 21 and 35 years of age with molars that were chewed completely flat, with no sign of cusps left. Something not observed among white people is a lower first molar with three well-formed and separated roots. They look more like the roots of upper first molars, with this exception, the mesial root is not longer than the others. (Among 134 extracted lower first molars, I found eleven with three roots.) Until quite recently, it was the custom among the tribes to file the front teeth of children as soon as they came to the age of puberty, filing the teeth from the left upper to the right upper cuspid. This custom is fortunately dying out, but I still found among 368 children, thirty-three filed teeth. In thirty-two cases, they were only slightly filed, about 1 mm., and not much harm had been done. One boy, however, had the six teeth filed down to the gums, with open gangrenous root-canals. Among older people, this extensive filing can be frequently observed. I could not obtain a definite explanation for the custom.

SUMMARY

1. School children to the number of 1,455 of the Malayan population have been examined and treated during two years. Of these, 56.43 per cent needed treatment.

2. There was a distinct difference in caries frequency between town children and children up country.

3. Only diet could be found to explain this difference, and, in the diet, the carbohydrates play the leading rôle. Home grown and unrefined carbohydrates that contain ample minerals and vitamins are eaten up country. Commercial food, lacking in minerals and vitamins, are eaten in town. Dental caries can be compared, under these circumstances, to deficiency diseases such as beriberi.

4. Third molars are generally well developed and in good anatomic position.

5. Lower first molars with three well-formed and separated roots were found.

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DENTISTRY A CAREER: NEW SOUND MOTION PICTURE

Do you know that you now have access to a new and interesting 16 mm. sound film on the training and education of a dentist? "Dentistry a Career" is primarily designed for vocational guidance classes; yet it is equally interesting to service clubs, professional organizations and business groups. The film presents the educational prerequisites for entrance to dental college and a résumé of the four-year course, with excellent shots of laboratory, lecture room and clinic show classes in anatomy, chemistry, bacteriology and other courses. Classes in operative dentistry, prosthodontia, orthodontia, children's dentistry and oral surgery are also shown.

The film, produced by Thomas B. McCrum, of Kansas City, is approved by the Dental Health Education Committee of the A.D.A.

The next time that you need a film for a high school or adult audience, write for this one. Address your request to the Bureau of Public Relations, A.D.A., 212 E. Superior St., Chicago, Ill. The rental fee is $2, plus express charges.

TEACHING MOUTH HEALTH IN NORTH CAROLINA

A HANDBOOK FOR TEACHERS. By Carolyn Morton Mercer, Educational Consultant, Division of Oral Hygiene, North Carolina State Board of Health, Raleigh, N. C.

As stated by Ernest A. Branch, director, Division of Oral Hygiene, North Carolina State Board of Health, in the foreword, this book "is designed to give those interested in the health of children pertinent information on the subject of mouth health and to suggest goals, content and tool materials for an effective mouth health education program."

Its 103 pages are divided into an introduction, five chapters, a bibliography and an appendix. The introduction consists largely of an explanation as to why North Carolina children need a mouth health program and a résumé of the activities of the Division of Oral Hygiene.

Chapters one and two consist of facts about children's teeth written in a clear, concise and non-technical manner. Chapters three and four outline the aims of mouth health teaching and offer a number of practical suggestions regarding procedures and teaching activities. Probably the most helpful chapter in the entire book is chapter five, the fifty pages of which offer a graded, selected and annotated bibliography on mouth health materials. The author has used excellent care in the selection of references, few of which can be criticized. In fact, the materials listed in chapter five and in the two page bibliography should be most helpful to any educator who wishes to teach mouth health.

COUNCIL ON DENTAL THERAPEUTICS

DECOMPOSITION OF PROCAINE HYDROCHLORIDE AND RELATED ESTERS IN AQUEOUS SOLUTION

By DONALD A. WALLACE, Ph.D.,* and HAROLD L. HANSEN, Ph.D., Chicago, Ill.

The Council has authorized publication of this report of an investigation conducted in the American Dental Association Bureau of Chemistry. HAROLD L. HANSEN, *Secretary.*

OF the numerous injectable local anesthetics now available, procaine hydrochloride, U.S.P. (2-diethylaminoethyl p-aminobenzoate hydrochloride) is the most widely used. This compound possesses only feeble topical anesthetic properties, but its aqueous solution is very effective when injected.

When procaine hydrochloride was first introduced, the solutions were prepared extemporaneously by physicians, dentists and pharmacists. With the passage of time and the development of manufacturing procedures, a number of firms presented a variety of packaged solutions to the professions. Because of their convenience, enormous numbers of ampuls and cartridges of local anesthetic solutions are now used annually, particularly by dentists.

The discovery by Gros[1] that the addition of such substances as disodium phosphate to local anesthetic solutions enhances the anesthetic effect of procaine hydrochloride under certain laboratory conditions was not given serious consideration by dental clinicians until comparatively recent times. Ten or fifteen years ago, however, interest in the findings of this investigator was revived, and there then appeared in the dental literature a number of papers which purported to show clinical advantages in "alkalinization" of anesthetic solutions. More recent clinical findings have cast some doubt upon the validity of the earlier optimistic reports.

It is not the purpose of this presentation to enter into a discussion of the relative merits of the several types of procaine hydrochloride solutions now available. It should be evident, however, that the widespread sale and use of such solutions prompt questions dealing with pharmacology, bacteriology, biochemistry, histology and pharmaceutic chemistry.

It was the primary purpose of this investigation to study the rate and extent of hydrolysis of procaine hydrochloride in aqueous solution at several pH levels. The secondary purpose was to make preliminary observations on the effect of different substituents and of variation in the position of substituents in the benzene ring of the anesthetic compound on the rate and extent of hydrolysis.

That the first line of investigation is not new can be inferred from the number of reports dealing with the methods of analysis [2, 7, 9, 10, 11, 13, 14] and the deterioration [2, 3, 4, 5, 6, 8, 9, 10, 12] of procaine hydrochloride in aqueous solution. However, the reports are widely scattered and incomplete, and it was deemed necessary for our purposes to have data obtained under uniform conditions. The second line of investigation has received little attention as far as local anesthetic compounds are concerned.

We therefore undertook a study of (a) the deterioration of procaine hydrochloride in buffered solutions of the following pH values: 1.9, 3.1, 5.4 and 6.5,

*Associate Chemist, A.D.A. Bureau of Chemistry.

and (b) the deterioration in unbuffered aqueous solution of 2-diethylaminoethyl benzoate, its ortho-, meta- and para-nitro and its ortho- and para-amino derivatives. Unfortunately, we were unable to prepare sufficient quantities of pure 2-diethylaminoethyl m-aminobenzoate for this study.

The concentration of compounds to be studied was 0.0734 molar in each instance. This value corresponds to 2 per cent weight by volume in terms of procaine hydrochloride.

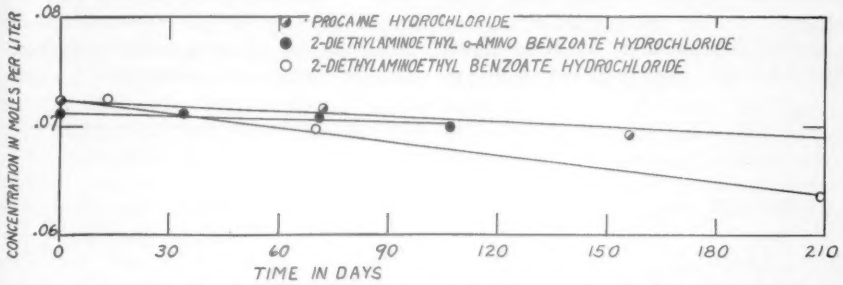

Fig. 1.—Decomposition of unbuffered aqueous solutions of 2-diethylaminoethyl benzoate hydrochloride and its ortho- and para-amino derivatives. Concentration (assay values) vs. time at 38°C.

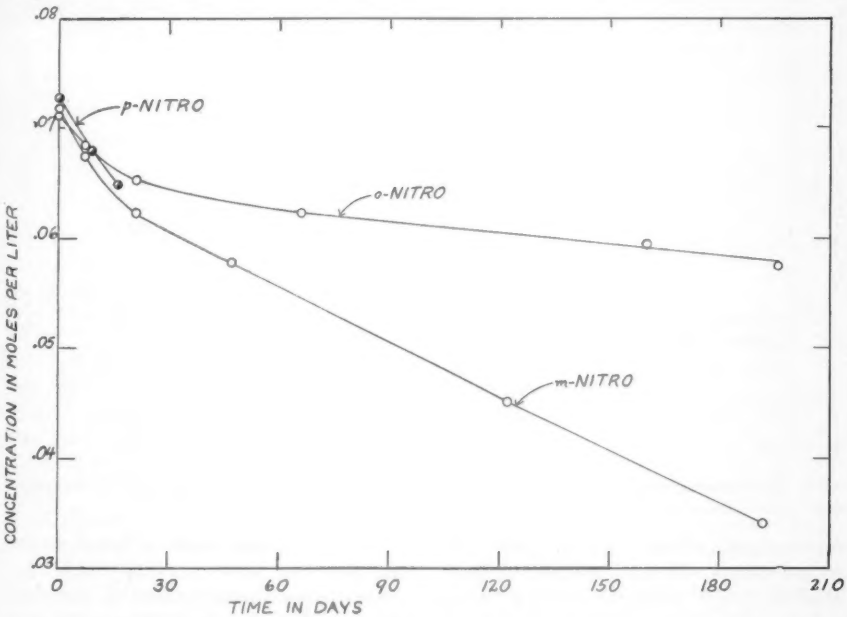

Fig. 2.—Decomposition of unbuffered aqueous solutions of mono-nitro derivatives of 2-diethylaminoethyl benzoate hydrochloride. Concentration (assay values) vs. time at 38°C.

MATERIALS

Procaine hydrochloride, U.S.P., was recrystallized from absolute ethyl alco-

hol (melting point 154.5-155.2°C.).

2-diethylaminoethyl benzoate hydrochloride was prepared from 2-diethylaminoethanol and benzoyl chloride. The hydrochloride was crystallized from an anhydrous mixture of ether and ethyl alcohol (melting point 124-126°C.).

2-diethylaminoethyl p-nitrobenzoate hydrochloride was prepared from p-nitrobenzoyl chloride and 2-diethylaminoethanol. It was crystallized from absolute ethyl alcohol (melting point 176.5-179°C.).

2-diethylaminoethyl m-nitrobenzoate hydrochloride was prepared from m-nitrobenzoyl chloride and 2-diethylaminoethanol essentially according to the method of Trefouel, Trefouel and Barbelet [18] (melting point 179.5-181°C.).

2-diethylaminoethyl o-nitrobenzoate hydrochloride was prepared from o-nitrobenzoyl chloride and 2-diethylaminoethanol essentially according to the method of Trefouel, Trefouel and Barbelet [15] (melting point 162-163°C.).

2-diethylaminoethyl o-aminobenzoate hydrochloride was prepared by reduction of the ortho-nitro compound.[15] The product was white with a faint purple cast (melting point 122-124.5°C.).

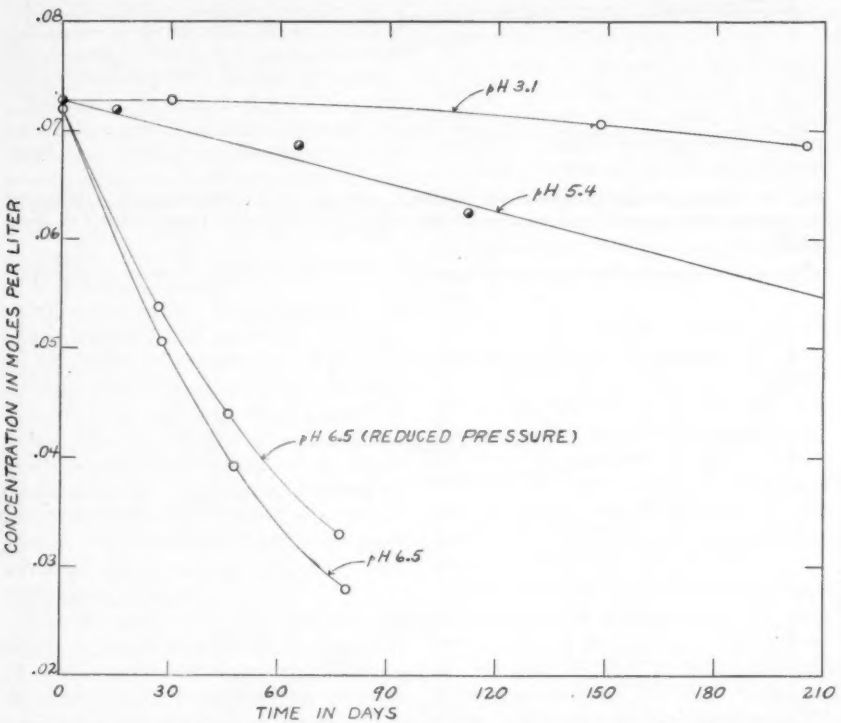

Fig. 3.—Decomposition of buffered aqueous solutions of procaine hydrochloride. Concentration (assay values) vs. time at 38°C.

Short-stem thermometers of the Anschutz type which had been calibrated at the National Bureau of Standards were used in melting point determinations.

Buffered Solutions.[17]—Glycine, acetate and phosphate buffers were employed. For example, in the preparation of the

pH 3.1 solution, 10 gm. of procaine hydrochloride was dissolved in 400 ml. of Sorensen's "glycine solution" and diluted to 500 ml. with 0.1008 normal hydrochloric acid.

EXPERIMENTAL PART

Within a few hours after their preparation, the solutions were divided among Pyrex glass ampuls, the air above the solution was swept out with nitrogen and the ampuls were sealed and placed in an oven set at 38.0°C. and thermostatically controlled to within ± 0.5°C.

A portion of the solutions, buffered at pH 6.5, was sealed under vacuum in especially designed ampuls. About 1 inch below the neck of an ordinary ampul, a constriction was made, and a mark was scratched on the narrowest

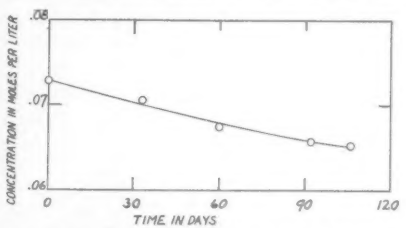

Fig. 4.—Decomposition of aqueous solution of procaine hydrochloride buffered at pH 1.9. Concentration (assay values) vs. time at 38°C.

portion thereof. The ampul was filled to the mark with the solution, which was boiled at or below room temperature for five minutes by maintenance of a carefully regulated low pressure. The ampul was sealed off under a vacuum and placed in the oven. The ampul, when removed from the oven for analysis, was cooled quickly to room temperature. The seal was broken and the solution was diluted to the scratch mark with distilled water and mixed.

Methods of Analysis.—A Beckman glass electrode pH meter was used for measurement of the pH.

The assay method, which was essentially that of the National Formulary,[13] consisted of liberation of the free ester by addition of dilute ammonium hydroxide solution; extraction with chloroform; evaporation of the chloroform in a stream of warm air (temperature of the air 80-90°C.); evaporation for a further period* of fifteen minutes, during which the flasks containing the extract were kept in a water bath at 60°±2°C., and the stream of warm air was continued; solution of the extract in alcohol, addition of a measured excess of standard hydrochloric acid, and titration with standard carbonate-free sodium hydroxide solution. In our hands, this method has given reproducible results, which, for pure compounds, are always appreciably lower than the calculated values.

DECOMPOSITION OF UNBUFFERED AQUEOUS SOLUTION OF PROCAINE HYDROCHLORIDE*

Days	Per Cent of Original Strength	pH
0	100	5.5
18	—	4.6
72	99	—
156	96	4.1
297	93	4.1
374	92	4.1

*Temperature, 38°C.; original strength, 0.0734 molar.

Data.†—From the curves shown in

*This step, which is designed to remove any 2-diethylaminoethanol which may be present, was omitted in the assay of 2-diethylaminoethyl benzoate and 2-diethylaminoethyl o-aminobenzoate because it was found that these two compounds were appreciably volatile under these conditions.

†It will be noted that the curves for procaine hydrochloride unbuffered (Fig. 1) and buffered at pH 5.4 (Fig. 3) extend beyond the last points shown in the figures. The determinations upon which these particular curves were based extended over a period somewhat longer than a year, whereas the points shown represent only the first 210 days.

Figure 1, it may be concluded that, of the three esters shown, the o- and p-aminobenzoates are more stable than the benzoate under the conditions of test.

Figure 2 indicates that the o-nitrobenzoate is definitely more stable than the m-nitrobenzoate. By comparison with Figure 1, which is drawn to the same scale, it will be noted that the nitro derivatives are less stable than the benzoate or the o- or p-aminobenzoates. Crystals, presumably of p-nitrobenzoic acid, appeared in quantity in the p-nitrobenzoate solution on the twentieth day.

In Figure 3, the curves for the more acid buffered solutions, when supplemented by data for unbuffered procaine hydrochloride solution (table), are of particular interest.

It will be noted in the accompanying table that the "unbuffered" solution of procaine hydrochloride solution was actually well buffered by its decomposition products after the 156th day of the test. Its rate of hydrolysis during the period from the 156th day until the 374th day was nearly the same as that of the solution buffered at pH 3.1 (Fig. 3).

A curve which shows the hydrolysis of a 2 per cent solution of procaine hydrochloride buffered at pH 1.9 is shown in Figure 4. Although such a solution is without clinical importance at this time, it is of interest to observe, by comparison with the table and Figure 3, that its rate of hydrolysis is greater than that of solutions buffered at pH values of 3.1 and 4.1.

Of the procaine hydrochloride solutions studied, those of pH 3.1 and 4.1 were the most stable toward hydrolysis at 38°C. Those solutions that were higher or lower in pH value were less stable.

Figure 3 also illustrates that a solution of procaine hydrochloride buffered at pH 6.5 hydrolyzed rapidly, and that sealing such a solution under reduced pressure improved the stability of the procaine only slightly. Evidence from other sources indicated that solutions with pH values higher than 6.5 are even more unstable.

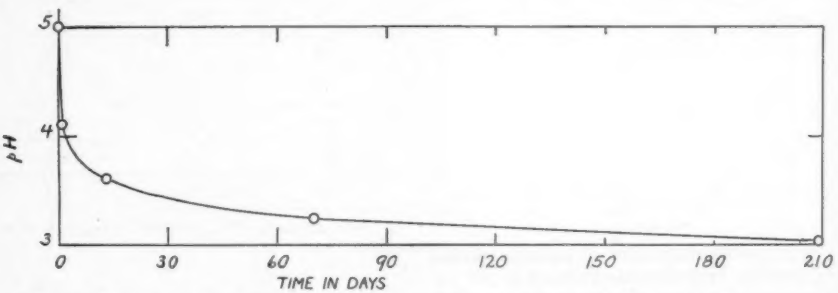

Fig. 5.—Decomposition of 0.0734 molar aqueous solution of 2-diethylaminoethyl benzoate hydrochloride. Temperature 38°C.

From a general knowledge of their characteristics, it would be expected that the pH values of unbuffered aqueous solutions of compounds of the type examined in this study would drop rapidly during the early stages of hydrolysis, and later much more slowly as the organic acids that are among their hydrolysis products were formed. In this study, the values obtained for pH followed the expected trend in every instance.

An illustrative curve, that for 2-diethylaminoethyl benzoate, is shown in Figure 5.

SUMMARY

1. 2-diethylaminoethyl benzoate was found to be less stable toward hydrolysis in unbuffered 0.0734 molar aqueous solution than its o- and p-amino derivatives.

2. Under similar conditions, 2-diethylaminoethyl o-nitro benzoate was found to be more stable than the corresponding m-nitro compound. All three nitro derivatives were less stable than 2-diethylaminoethyl benzoate.

3. Of the pH values studied, the greatest stability of procaine hydrochloride toward hydrolysis was found at pH 3.1 and pH 4.1. At pH values markedly above or below these levels, hydrolysis was found to be more rapid.

4. A procaine hydrochloride solution buffered at pH 6.5 hydrolyzed very rapidly. Sealing the solution under reduced pressure reduced the rate of hydrolysis only slightly.

5. The pH values of unbuffered solutions of the compounds studied dropped more rapidly than did their assay values during early stages of decomposition.

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FEDERAL TRADE COMMISSION ORDER ON HYRAL

THE Federal Trade Commission ordered Hyral Distributing Co., and Wallace G. Clark and Norman A. Dodge, of Fort Worth, Tex., to cease and desist from misrepresentations in the sale of "Hyral," a dental preparation.

Commission findings are that prior to 1937, when Hyral Distributing Co., a corporation, obtained a license to do business in Texas, the respondents Clark and Dodge conducted the same business as a copartnership under the trade name of Hyral Distributing Co.; that some of the representations involved in the Commission proceeding were made by the respondent copartnership during its existence, and that others were made subsequently by the respondent successor corporation.

The Commission order directs the respondent corporation and the respondents Clark and Dodge as individuals to cease and desist from representing that the preparation "Hyral" is a new discovery, has germicidal properties, is a cure or remedy for bleeding gums or other mouth disorders or constitutes an effective treatment for such conditions in excess of that afforded by a mild antiseptic.

These respondents also are ordered to cease representing that their preparation is a cure or remedy for "trench mouth" or an effective treatment therefor in excess of temporarily inhibiting the growth of the bacteria causing "trench mouth."

The order further prohibits the representation that Hyral has therapeutic value in the treatment of pyorrhea or is a remedy for pyorrhea; that it will make the gums firm, hard or healthy; that its use will prevent loss of teeth; that the preparation will remove tobacco stains or tartar, or that it will have any effect on unpleasant breath odors in excess of temporarily masking them.

The Commission order further directs the respondent corporation and the respondents Clark and Dodge, both individually and as its officers and directors, to cease disseminating advertisements which represent that their preparation is a new or different dentifrice or has any special properties which would be effective in making or keeping the gums firm. (Order No. 3726)

FEDERAL TRADE COMMISSION STIPULATION ON WALKER'S FAMOUS TOOTH POWDER

JAMES J. WALKER, JR., 3614 Calumet Ave., Chicago, stipulated with the Federal Trade Commission that he will cease advertising that "Walker's Famous Tooth Powder" stops receding or bleeding of gums, makes gums firm or sound or heals them, tightens loose teeth or makes the teeth white. The respondent also stipulates that he will desist from representing that millions of people use Walker's Famous Tooth Powder, when such is not a fact. (Stipulation 02773)

ACCEPTED DENTAL REMEDIES

The Council on Dental Therapeutics of the American Dental Association announces the inclusion of the following articles in the list of Accepted Dental Remedies.

Dentifrices

LeBon Tooth Paste: Composition: See Milkident Tooth Paste (A.D.R. Ed. 6, p. 118).
Manufactured by The Trade Laboratories, Inc., Newark, N. J. Distributed by Drugwell, Inc., Newark, N. J.

Liberty Tooth Paste: Composition: See Milkident Tooth Paste (A.D.R. Ed. 6, p. 118).
Manufactured by The Trade Laboratories, Inc., Newark, N. J. Distributed by Liberty Cosmetic Company, Detroit, Mich.

Hales Tooth Paste: Composition: See Milkident Tooth Paste (A.D.R. Ed. 6, p. 118).
Manufactured by The Trade Laboratories, Inc., Newark, N. J.

Schuster's Tooth Paste: Composition: See Sheffield Tooth Paste (A.D.R. Ed. 6, p. 120).
Manufactured by The Sheffield Company, New London, Conn. Distributed by Ed. Schuster & Co., Inc., Milwaukee, Wis.

Admission of an article to the list of Accepted Dental Remedies does not imply a recommendation. Information regarding the rules and work of the Council will be sent on request.

HAROLD L. HANSEN, *Secretary.*

COMMITTEE ON ECONOMICS

THE DENTIST AND SOCIAL SECURITY

By JOHN J. CORSON,* Washington, D. C.

THE average dentist comes into the social security program, at present, only at the paying end. Every three months, he takes the 1 per cent that he has subtracted from the wages of his receptionist, hygienist or nurse, adds an equal amount from his own pocket, and sends the total along with his tax return, to the collector of internal revenue. He has the satisfaction of knowing that he is helping his employes to provide themselves with security in their old age, and with an income for their dependent survivors in the event of death. But what of the dentist himself? Unless he is one of the relatively few salaried or part-salaried men, in which case he may be building up his own old-age and survivor's insurance fund, he now stands entirely outside the system. He is left to cope with the economic hazards of old age as best he can.

The peculiar income and retirement problems of dentists arise from the very nature of dental practice. The dentist not only must be a highly trained professional man in an important branch of medical science, but also must be skilled in the use of delicate, high-speed, precision instruments. As steadiness of hand and eye are lost with increasing age, income goes down. Data gathered in a survey of economic conditions in the dental profession[1] indicate that the average dentist is at the peak of his earning power between the ages of 35 and 39, when the average net annual income is $3,658. Thereafter, the average dentist's income declines until, at age 55, it goes below the average income level for the profession as a whole. In the age group 60-64, the average net income is just a little more than $2,000 a year. This means that a good sector of the dentists in this age group have incomes lower (some of them much lower) than this average.

A recent poll of a representative cross-section of the profession[2] showed that dentists were well aware of their retirement and old-age income problems. Of the dentists who returned questionnaires, 77 per cent indicated that they would favor a system of old-age insurance for dentists under the Social Security Act; a total of 79 per cent would favor a voluntary system for the profession, and 56 per cent declared that they would be willing to come in under a compulsory system.

HOW THE PRESENT SYSTEM WORKS

Under the Social Security Act Amendments of 1939, benefits first became payable as of January 1, 1940. These benefits are available not only to retired workers aged 65 or more, but also to the wives over 65 and children (under 16, or under 18 if attending school) of these primary beneficiaries. Monthly benefits are provided also for the widows and children, and, in some cases, for the dependent parents, of insured wage earners who die. Lump-sum payments may be made upon the death of insured workers who leave no survivors entitled to receive monthly benefits.

The basic primary benefits are com-

*Director, Bureau of Old-Age and Survivors Insurance, Social Security Board.

1. U. S. Department of Commerce: Economic Conditions in Dental Profession, 1929-1937, September 1939.

2. Dentists on Social Security. *D. Survey*, 16:1272-1274, November 1940.

puted by taking 40 per cent of the first $50 of the worker's average monthly wage, and adding 10 per cent of the average monthly wage above $50 and not in excess of $250. This result is increased by 1 per cent for each year in which the worker was paid $200 or more in employment covered by the act. The wife of a retired worker in receipt of benefits, if she is 65 years of age or over, may receive a benefit equivalent to 50 per cent of the primary benefit; the aged widow, or the widow having a child of the wage earner in her care, 75 per cent of the primary benefit, and each child or dependent parent, 50 per cent. The minimum monthly benefit payable to a single individual or family is $10. The maximum payment is $85 a month, 80 per cent of the worker's average monthly wage or twice the primary benefit, whichever is the least.

Primary benefits payable at various levels of average monthly wage and years of coverage are given in the accompanying table. As explained previously, all other benefits are based on the amount of the primary benefit.

Contributions to support the old-age and survivors insurance system are levied upon workers and their employers in equal amounts. Through 1942, both the wage earner and the employer pay 1 per cent on all wages up to $3,000 a year. The contribution rate is increased by 1 per cent for each in 1943 and by one-half of 1 per cent in 1946 and in 1949. After January 1, 1949, the contribution rate remains at 3 per cent for the employe and an equal amount for the employer, a total of 6 per cent.

When the employer sends in his social security contribution, he transmits with it a report form on which are listed the names, social security account numbers and amount of wages of each of his employes. The report form, after being checked in the Bureau of Internal Revenue, is sent to the Bureau of Old-Age and Survivors Insurance, where, by a mechanical accounting process, each employe's wages are posted to his individual account, among the fifty-four million accounts established. It is on the basis of his individual account that each worker's old-age insurance benefit and the benefits for his dependents are calculated.

But what does all this accomplish? What is social insurance for, after all? This program accomplishes three things: 1. It protects not only the individual, but also society, through the prevention of dependency. 2. It provides the individual with essential income in his old age (or provides for his family in the event of his death), on the basis of his previous contributions, rather than on the basis of need, as exemplified by assistance programs which require "means tests." 3. It provides a logical and orderly insurance protection for the worker against the wage loss suffered at retirement, or against the loss suffered by his dependents by reason of his death. Under this program, the family, rather than the individual, is the unit of protection, and emphasis is placed upon the adequacy of benefits to provide at least a minimum of subsistence for each beneficiary.

PRIMARY BENEFITS PAYABLE AT VARIOUS LEVELS

Years of Coverage	Average Monthly Wage			
	$50	$100	$150	$250
3	$20.60	$25.75	$30.90	$41.20
5	21.00	26.25	31.50	42.00
10	22.00	27.50	33.00	44.00
20	24.00	30.00	36.00	48.00
30	26.00	32.50	39.00	52.00
40	28.00	35.00	42.00	56.00

EXTENDING SOCIAL SECURITY PROTECTION

Events of recent years have given great impetus to demands that the social security program be extended to groups not now covered. A number of bills have been introduced in Congress the

purposes of which range all the way from the extension of coverage to special groups of the population to the establishment of a universal pension system. The Social Security Board has given much study to proposals for extension of coverage, and is now formulating the basic considerations on which successful extension of coverage must rest. Some difficult administrative problems must be solved before independent professional persons, small businessmen and the self-employed generally can be brought into the old-age and survivors insurance system.

One of the major proposals advanced for extending coverage envisions voluntary insurance systems for special groups of the population, to be financed by contributions from the participating members of these groups. This proposal is open to serious objections. If the insurance is provided at somewhere near cost, under this plan, the rates would be comparable to those charged by private insurance companies for similar protection. If the experience of foreign countries with voluntary plans is any indication, participation would be limited to a negligible percentage of the group. If, on the other hand, a government subsidy is provided to keep rates low and to make the plan more attractive, the system would soon find itself facing the problem of "adverse selection," to use the insurance term. Persons near retirement age or in poor health would rush to take advantage of a system which would pay them or their survivors a large return on a relatively small investment. This overloading of the system with bad risks would upset the original intention of financing the plan from the contributions of participating members and necessitate substantial government subsidies to keep the plan going. At the same time, the lowest income class within the group, those who need protection most, may consider themselves financially unable to participate. Thus the social purpose of old-age and survivors insurance would be defeated.

As an alternative to this plan, the entire self-employed population might be covered under the present old-age and survivors insurance system. Such a system would eliminate the problems of adverse selection and excessive cost raised by the voluntary system, and would bring in the low-income class. Under this system, self-employed persons would pay contributions equal to the sum of the employer and employe tax, probably on the basis of net income (up to $3,000) for the preceding year. The principal administrative problems involved in this plan lie in the determination of net income and in the collection of the tax. For those persons who are themselves employers of covered workers, the tax could be included on the regular social security report form. An alternative method of collection would be on the basis of the Federal income tax return. The latter method would also aid in the determination of net income. For those in income groups so low that they are not required to file tax returns, some other method of collection would have to be devised.

LEGISLATION PENDING IN CONGRESS

More than 100 bills relating directly or indirectly to the old-age and survivors insurance program have been introduced in the present session of Congress. Two categories of bills that would affect the dental profession may be noted here. In the first category, there are the bills that would supersede the present Social Security Act and establish a system of universal old-age pensions. One group would provide fluctuating monthly pensions, as determined by the amount of revenue derived from a "gross income" tax, for all citizens 60 years of age or over. The other group would provide flat pensions (varying in amount in the different bills introduced) to be financed, in the case of one bill, by a "gross profit" tax and, in the case of another, by a

"pay-as-you-go" pension money certificate system. If any of these bills are enacted, the entire population, including the self-employed, will be covered.

In the second category are the bills designed to increase the scope of the present old-age and survivors insurance system. A few of these proposals would affect certain dentists: the amendments that would expand the system to include employment for religious, charitable and nonprofit institutions (except for regularly ordained ministers and members of religious orders); state and local government employment, and active service in the armed forces. These bills would bring into the system dentists who are employed by such institutions or governments, or who serve with any branch of the armed forces. No bills have as yet been introduced that would specifically extend coverage to independent practitioners or other self-employed persons.

Certainly, dentists should share, if they so desire, in the basic "floor of protection" that has already been established for a large percentage of our population. There are signs of a growing demand for old-age and survivorship protection among the self-employed in general, and among specific groups, such as the dental profession. It is to be hoped that this demand will be translated into a wise and practical program for action. A system for "security" that does not work may be worse than no system at all. However, a sound and workable solution is being developed to provide protection for all self-employed persons, including the dentist.

IN order that the dental profession may be fully informed regarding the provisions of the Old Age and Survivor's Insurance plan, the Social Security Board, at the request of the Committee on Economics, plans to mail to each member of the Association a circular entitled "Old Age and Survivor's Insurance for Workers and Their Families." This circular, to be mailed some time before June 15, gives additional details regarding the program, which, for lack of space, could not be included in Mr. Corson's article.

Committee on Economics.

NATIONAL HEALTH PROGRAM COMMITTEE

RESEARCH BILL

THE Dental Research Bill (S.194), which appropriates $75,000 annually to the United States Public Health Service for the study of dental diseases, has been reported favorably by the Senate Committee on Education and Labor, which has had the bill under consideration since its introduction, by Senator James E. Murray, January 6, 1941. The bill now goes to the Senate for a vote.

"PROGRAMS FOR DENTAL HEALTH"

The National Health Program Committee has just issued a booklet, "Programs for Dental Health." A copy has

been mailed to every member of the American Dental Association and additional copies are available upon request.

The booklet contains suggestions for the establishment of dental health programs in the community, state and nation. It also contains brief descriptions of dental programs that are now being conducted under the supervision of the federal government.

STATE COMMITTEES

The committee has requested every state dental society to appoint or designate a committee to cooperate with the National Health Program Committee on matters of common interest. This committee would have a personnel that would not be changed in its entirety each year, to allow for continuity of experience and planning. Members of such state committees will receive periodic bulletins of current information. Various agencies have agreed to inform the National Health Program Committee of their intention to initiate dental projects in the various states. This information and other essential data will then be communicated to the state committee for consideration and action.

AMERICAN DENTAL ASSOCIATION MEMBERSHIP

ON the following page, the membership page makes another appearance. This feature of THE JOURNAL first appeared in the February 1941 issue and has been published in each issue since that time.

The original purpose of the chart was to show the percentage of membership in each constituent society as it existed at the close of each calendar month. After the chart appeared in the February, March and April issues, it was decided that, by a slight change, it could be made to show not only the percentage of membership at the close of each month, but, at the same time, the comparison of that membership with the membership as it was at the close of the calendar year.

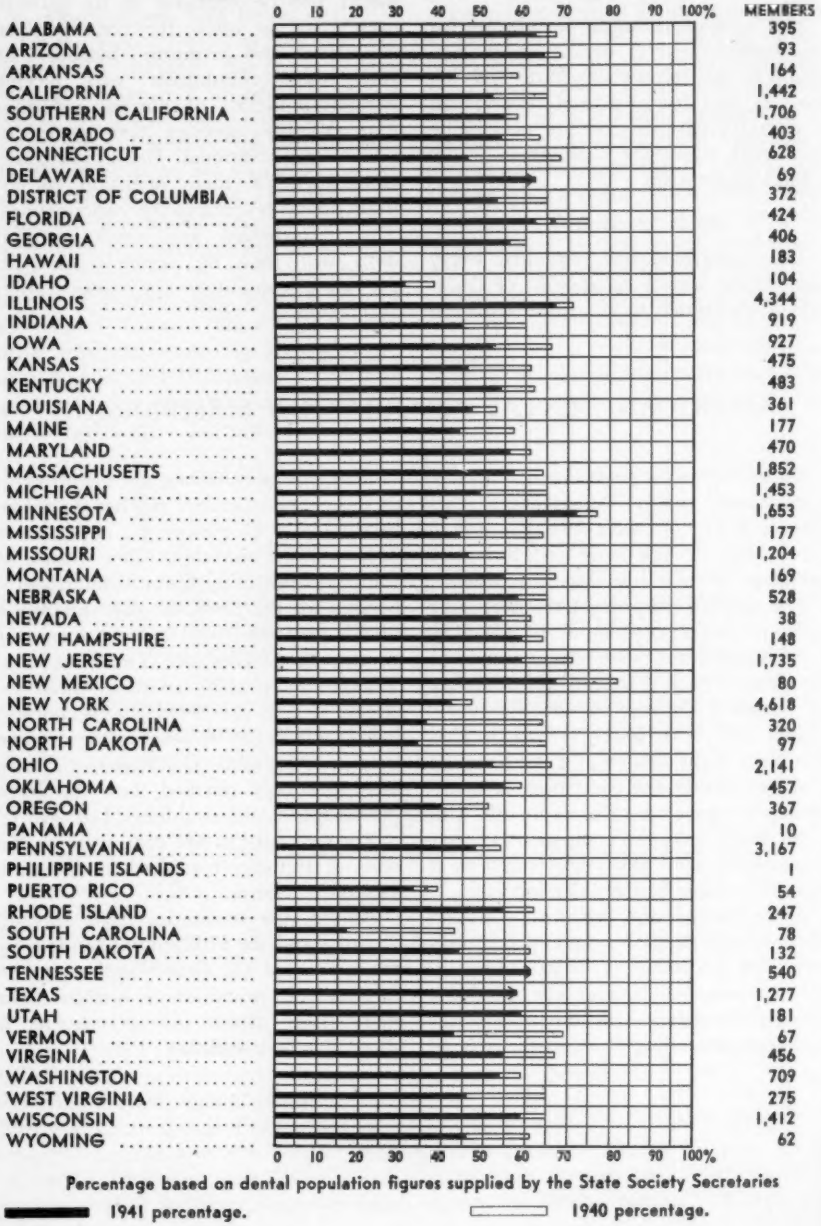
As the chart is now prepared, the open line indicates the percentage of membership as of December 31, 1940. The solid line represents the percentage as of the close of the second calendar month immediately preceding the month of issue of THE JOURNAL. When the membership in a constituent society reaches the membership as of December 31, 1940, this is indicated by two short lines drawn at the point indicating the maximum membership for the previous year. Examples of this are to be found in the percentages shown for Delaware, Tennessee and Texas. In referring to these three societies, it is to be noted that Tennessee has reached the maximum percentage held in 1940, while Delaware and Texas have not only reached, but also have passed the record established last year.

The percentages are computed on the basis of statistics furnished by the state society secretaries.

As yet, the secretaries from Hawaii, Panama and the Philippine Islands have not submitted the figures indicating the number of practitioners within their jurisdiction, hence no percentage is shown for their societies.

Membership Page

PERCENTAGE OF DUES RECEIVED IN CENTRAL OFFICE AS OF APRIL 30, 1941 AS COMPARED TO 1940 MEMBERSHIP



Percentage based on dental population figures supplied by the State Society Secretaries

1941 percentage. 1940 percentage.

HOUSTON—HOST TO THE A.D.A.—OCTOBER 27-31

HOUSTON, like the dental profession which it entertains next October, is but one hundred years old. It was founded in 1836 and named for General Sam Houston, hero of the Battle of San Jacinto and first president of the Republic of Texas.

From a log cabin frontier town on a sleepy bayou, Houston has grown to its present position of industrial leadership in the South. The Port of Houston, third largest in the nation, is daily filled with ships that ply the seven seas. Houston, we are told, is America's fastest growing city. It is served by six major railroad systems, three transcontinental airlines and nine great steamship companies. Its thirty-two hotels offer 5,000 modern, comfortable rooms of all sizes and at reasonable rates. In addition, it has several hundred multiple room apartments. All leading hotels are "air conditioned" and are located within the business loop.

The new $2,000,000 Sam Houston Coliseum is centrally located and within easy walking distance of the principal hotels. It contains 175,000 square feet of exhibit space and thirty-six meeting rooms. The music hall seats 2,000 and is completely air conditioned.

San Jacinto Memorial Shaft, near Houston, Texas

Plan now to attend this year's meeting in the great Southwest—Houston, October 27-31.

American Dental Association

Houston, Texas October 27-31, 1941

HOTEL RESERVATIONS

To secure hotel accommodations for the 1941 Meeting, consult the rate list below and fill out the attached blank. Mail this immediately to the hotel of your first choice or to the Housing Committee, Room 344, Rice Hotel, Houston, Texas. Confirmation will be sent to you by the hotel.

Second and third choices of hotel should be indicated. If the reservation cannot be made at any of the hotels of your choice, the Housing Committee will place you in as favorable a hotel as possible and will notify you.

Please remember that a reservation constitutes a contract with the hotel to provide you with the accommodations you desire. If you find it impossible to carry out your part of the contract, namely, to occupy the room at the time agreed upon, please write or wire the hotel releasing the room, in order that it may be available for other members.

APPLICATION FOR HOTEL ACCOMMODATIONS

AMERICAN DENTAL ASSOCIATION

Houston, Texas October 27-31, 1941

HOTEL.....1st choice

HOTEL.....2nd choice

HOTEL.....3rd choice

Kindly reserve the following: ☐ Single room ☐ Double room ☐ Twin beds.

.....rooms with bath for.....persons $.....per room

.....rooms without bath for.....persons $.....per room

Arriving on October.....at.....a.m.....p.m.

ROOMS TO BE OCCUPIED BY:

NAME	ADDRESS IN FULL

NOTE TO HOTEL NAMED AS FIRST CHOICE: If the hotel of first choice is unable to make reservation requested, this application should be forwarded at once to the Housing Committee, Room 344, Rice Hotel, Houston, Texas.

SCHEDULE OF RATES

ALL ROOMS WITH BATH*

Hotels	Single	Double	Twin	Suites
AUDITORIUM, 701 Texas	$2.50–3–3.50	$3.50–4.50–5.50	$5	
BELMONT, 1308 Clay	$2	$3–3.50		
BRAZOS, 608 Preston	$2.50	$4	$4	
BRISTOL, 712 Travis	$2.50–3–3.50	$3.50–4–5	$4	
COTTON, Rusk and Fannin	$2–2.50–3	$3–3.50–4.50	$4	
DE GEORGE, 1418 Preston	$2	$3–3.50	$4.50–5.50	
FREDS HOTEL, 1006 Dallas	$1.50–2	$2–3	$2.50	
SAM HOUSTON, 1115 Prairie	$2.50–3–3.50	$4–5–6	$5–6	
HAMFORD APARTMENT, 919 Dallas	$1.50–2	$2–2.50		
HOUSTON CLUB, Commerce Building	$4–5–6	$6–7–8		
LAMAR, Main and Lamar	$3–4–5–6	$5–6–8–9	$5–7–8–9	$12–14–15–18–20–24
LAMAR ANNEX HOTEL, 916 McKinney	$2.50–3–4	$4–4.50–5–6	$5–6	
LEE, 1114 Polk	$2	$2.50–3	$3	
MACATEE, 519 Washington	$2–3–3.50	$3–4–5	$4–5	
BEN MILAM, 1521 Texas	$2.50–3–3.50	$3.50–4–4.50	$6	
MILBY, 902 Texas	$2–2.50–3	$3–3.50–4	$4–4.50–5	
OXFORD, 811 Lamar	$2	$3–4		
PARK, 610 Louisiana	$1.50	$2–2.50	$3	
WILLIAM PENN, 1423 Texas	$2–2.50–3–4	$3–3.50–4.50–5–5.50	$6	
PLAZA, 5020 Montrose	$3–3.50–4–5	$4.50–5–6–7	$6–7	$8–15
RHODES APARTMENT, 611 LaBranch	$2	$2.50–3		
RICE (Headquarters), Main and Texas	$3–4–4.50–5	$5–6–6.50–7–8	$6–7–8–9	$12–22–40
ROOSEVELT, 1111 Clay	$2	$2.50–3		
ROSSONIAN APARTMENT, 919 Fannin				$6–8
SAN JACINTO, 820 Main	$2.50–3–3.50–4	$4–4.50–5–5.50	$5.50–6–7–8	$10
STRATFORD, 414 Fannin	$2–2.50–3	$3.50–4–4.50	$4–4.50	
TENNISON, 801 Washington	$2	$3	$3.50	
TEXAS STATE, 720 Fannin	$3–4–5–6	$5–6–7–8	$6–7–8–9–10	$12–16–18–24
TRAVELERS, 114 Main	$1.50–2	$2–3		
WALEE, 1010 Caroline	$2	$2.50–3		
WARWICK, 5701 Main	$3.50–5	$3.50–5	$5–6	$6.50–7.50–9–11–18
WOODROW, 1412 Fannin	$2–2.50	$3–4–5		

*Rates on rooms without bath by request.

SEVENTY-FIFTH ANNIVERSARY OF WASHINGTON UNIVERSITY SCHOOL OF DENTISTRY

APRIL 7 to 12, 1941, ST. LOUIS, MO.

DURING the week of April 7, Washington University Dental School celebrated its seventy-fifth anniversary. In 1866, the Missouri State Dental Association, which had just been organized, founded the first dental school west of the Mississippi. In planning this, the Missouri Dental College, the dentist founders looked forward to the growth of the West and the development of dentistry as a scientifically practiced profession. They considered dentistry the equivalent of other medical divisions and accepted the offer of St. Louis Medical College to share lecture rooms, museum facilities and hospitals. When these two pioneering schools evolved into the dental and medical schools of Washington University, the same cooperation, without subordination, obtained. From this school have come many leaders in dentistry, including Greene Vardiman Black, John G. Harper, Thomas L. Gilmer, W. E. R. Koch and James H. Prothero. Among its alumni have been no less than nine dental school deans.

Even to the far-seeing pioneers who established their dental school as a project of organized dentistry, the program of postgraduate courses arranged by the Alumni Society, through O. W. Brandhorst, chairman, and his associates, would have been a revelation. Sixty-four persons representing sixteen dental schools, two medical schools, a state department of health and the United States Army contributed to the program. Their presentations in the general sessions and section meetings covered all phases of dental art and dental science. Included were anatomy, anesthesia, bacteriology, ceramics, children's dentistry, crowns and bridgework, dermatology, diagnosis, economics, education, embryology, histology, history, medicine, national defense, oncology, operative dentistry, orthodontics, pathology, periodontics, pharmacology, physiology, prosthetics, public health, root-canal therapy and surgery. One evening session was combined with a regular meeting of the St. Louis Dental Society, as a fitting tribute to organized dentistry, which conceived and nurtured the young school.

At a convocation of the university, seven dentists were honored with the degrees of doctor of science. Representatives of twenty-seven dental schools, two dental clinics and seven dental organizations, including the American Dental Association, were present, as well as the university faculties, alumni and friends. Charles W. Freeman, dean of Northwestern University, spoke on "Washington University's Contribution to Dental Education"; Benno E. Lischer, dean of Washington University, on "Claims of the Future"; George W. Wilson, assistant dean of Marquette University, on "Dentistry as a Profession," and Philip A. Shaffer, dean of Washington University School of Medicine, on "Dentistry in a University." Henry E. Sigerist, director of the Institute of Medical History of Johns Hopkins University, delivered the principal address, on "Developments and Trends in Dentistry." George R. Throop, chancellor, conferred honorary degrees on Brig.-Gen. Leigh C. Fairbank, United States Army; Philip Jay, University of Michigan; Paul C. Kitchin, Ohio State University; Hermann Prinz, University of Pennsylvania; Alfred P. Rogers, Harvard University; Isaac Schour, University of Illinois, and R. C. Willett, Peoria, Ill.

More than one-third of the living alumni of the school returned for the six-day program. To these men and women, the anniversary celebration presented opportunities for reviewing material learned as students, for acquiring new ideas and new technics, for renewing old acquaintances with persons, things and places. To American dentistry, such a celebration should represent the attainment of a professional and scientific milestone along a road laid out by a pioneering dental society and constitute a challenge to the profession for further contributions to dental education.

OBITUARY

WILLIAM L. DARNALL
(1889-1941)

WILLIAM L. DARNALL, Dental Corps, U. S. Navy, died April 29, 1941, in the Naval Hospital, Washington, D. C. He was born June 11, 1889, at Lebanon, Ind., and graduated from the University of Indianapolis Dental School, in 1913. He was first commissioned as a lieutenant (junior grade) in the Navy Dental Corps in August 1914, and was successively promoted to Senior Grade Lieutenant and Lieutenant Commander. In 1929, Dr. Darnall was raised to the rank of commander and in 1938 he was commissioned captain.

During his outstanding career in the Navy Dental Corps, Dr. Darnall served in many parts of the world. During the World War, he was stationed in the Far East, serving in China and the Philippines. In 1922, after a course of instruction in postgraduate work, he was assigned to duty in the Naval Dental School, Washington, D. C., where he demonstrated his ability as a teacher and leader of the student dental officers attending the school.

When the *U.S.S. Lexington* was commissioned in 1928, Dr. Darnall was assigned as dental surgeon in the Medical Department of that ship. From 1930 until 1939, he served one cruise as dental surgeon in the Naval Hospital, Parris Island, S. C., and two cruises in the Naval Hospital, San Diego, Calif.

In 1939, Dr. Darnall was designated dental officer in command of the Dental Department of the Naval Medical Center, where he was on duty when he was overcome by the illness resulting in his death.

Dr. Darnall was an active member of the American Dental Association and had been a Navy delegate on many occasions when his official duty permitted his attendance.

WILLIAM L. DARNALL
(1889-1941)

He had worked over a period of many years to emphasize the importance of organized dentistry to officers of the Navy Dental Corps and was instrumental

in securing naval membership for the American Dental Association. He was a member of the Delta Sigma Delta fraternity and a Fellow of the American College of Dentists.

Captain Darnall's favorite hobby was the betterment of educational facilities in all departments associated with the Naval Dental Corps. Ever on the alert for improvements in all phases of dentistry, his innovations and application of fresh ideas made him a great educator. In addition, his magnanimity set him as one apart from the average man. His patience and understanding were almost saintly. This man was the quintessence of gentleness to his fellow man. Sentimental almost to a fault, his kindly feeling for all under his command not only earned for him respect, but also instilled a tireless desire for working for him within all who were fortunate enough to have served under his command. His sincerity and simple straightforwardness gained for the Dental Corps many advantages which might otherwise have become submerged in hopeless confusion and debate. His plans were on a grand scale embracing no limit in time or scope. Realization of a step forward as already accomplished lit his eyes in almost childlike joy and made him zealous for further endeavor.

Among his last accomplishments was the organization of the three departments of the Naval Dental School into a coordinate functioning unit. The clinical, teaching and research departments were so arranged as to minimize duplication of effort and to facilitate operation. All this was planned especially for the new dental school that is to open shortly at the new Naval Medical Center at Bethesda, Md.

Captain Darnall's death marks the end of a full life and an enviable career. The Naval Dental Corps has lost one of its staunchest supporters and cannot but feel deeply grieved at their loss, as do the many other friends that he had.

Captain Darnall is survived by his widow, Zella O. Darnall, and two children, William L. Darnall, Jr., who is a student at Northwestern University Dental School, and Sarah Jane, the wife of First Lieut. L. Walker Smith, U.S.M.C.

Burial was at Arlington National Cemetery, May 2, 1941.

DEATHS

ALLEN, FRANK C., Bonham, Texas; Chicago College of Dental Surgery, 1890; died February 25.

BEATTY, ROBERT W., SR., New Kensington, Pa.; University of Pittsburgh School of Dentistry, 1904; died March 6; aged 64.

BENNER, JESSE A., Defiance, Ohio; University of Michigan School of Dentistry, 1901; died March 17.

BOYKIN, MATTHEW A., Mobile, Ala.; Atlanta Dental College, 1915; died December 5.

BROPHY, REUBEN C., Elgin, Ill.; Chicago College of Dental Surgery, 1896; died December 22; aged 84.

BUTLER, GEORGE C., Honesdale, Pa.; University of Pennsylvania School of Dentistry, 1905; died January 28.

DEWHURST, EDWARD B., Philadelphia, Pa.; University of Pennsylvania School of Dentistry, 1906; died February 25; aged 70.

FARRIER, JAMES J., Clarksville, Texas; Tulane University Dental Department, 1909; died January 30; aged 60.

FRANK, JAMES R., Pocatello, Idaho; formerly of Des Moines and Mitchellville, Iowa; died February 12; aged 62.

GALLAGHER, ROBERT E., Zelienople, Pa.; University of Pennsylvania School of Dentistry, 1898; died January 25; aged 75.

GINNELLEY, EDWIN H., Trenton, N. J.; National University Dental Department, 1886; died February 4.

GOTTSCHALDT, MARTIN C., New York, N. Y.; New York College of Dentistry, 1882; died February 25.

GRIESMER, MATTHEW F., Brooklyn, N. Y.;

New York College of Dentistry, 1908; died March 3.

GRUBER, FRANK LYMAN, Columbus, Ohio; Ohio State University College of Dentistry, 1902; died March 24.

HALL, LINCOLN C., Burlington, Iowa; State University of Iowa College of Dentistry, 1889; died February 19; aged 83.

HALLETT, JAMES A., formerly of Des Moines, Iowa; Des Moines College of Dental Surgery, 1899; died in California, January 30; aged 68.

HOWE, HORACE LEONARD, Boston, Mass.; Harvard University Dental School, 1898; died February 1; aged 66.

JONES, R. BULLOCK, Willimantic, Conn.; Temple University School of Dentistry, 1922; died May 9; aged 39.

JUUL, AXEL, Fargo, N. D.; Northwestern University Dental School, 1905; died January 3; aged 62.

KOEGLER, GEORGE H., New York, N. Y.; New York College of Dentistry, 1901; died January 14.

KYLER, JOHN F., Kirkwood, Ill.; Northwestern University Dental School, 1891; died December 15; aged 73.

LEVY, SEYMOUR S., New York, N. Y.; New York College of Dentistry, 1923; died February 1.

MAYFIELD, HOWARD E., San Angelo, Texas; died February 6; aged 68.

MILLER, ENOCH C., Findlay, Ohio; died February 9; aged 90.

MUNSON, ALFRED E., Detroit, Mich.; University of Michigan School of Dentistry, 1912; died February 5; aged 52.

MUSKOWSKI, EDWARD F., Detroit, Mich.; Marquette University School of Dentistry, 1924; died February 8; aged 41.

NORTHROP, HORACE W., New York, N. Y.; New York College of Dentistry, 1888; died January 23.

NUSSBAUM, BENJAMIN PRINZ, Brooklyn, N. Y.; New York College of Dentistry, 1915; died in January.

O'BRIEN, CHARLES D., Philadelphia, Pa.; University of Pennsylvania School of Dentistry, 1912; died recently; aged 55.

ORSHER, ISAAC, Philadelphia, Pa.; Medico-Chirurgical College, 1910; died January 16.

OWRE, AENEAS R., Minneapolis, Minn.; University of Minnesota School of Dentistry, 1900; died January 9.

PATTERSON, L. L., Clinton, Okla.; Tulane University Dental Department, 1906; died March 7; aged 61.

POPPE, MICHAEL U., Milwaukee, Wis.; Milwaukee Medical College Dental Department, 1904; died December 3; aged 57.

RALSTON, ELMER H., Duluth, Minn.; University of Minnesota School of Dentistry, 1916; died February 24.

RANK, LEO FRANCIS, Hoopeston, Ill., Northwestern University Dental School, 1915; died January 4; aged 50.

REED, GLENN F., Dayton, Iowa; State University of Iowa College of Dentistry, 1908; died February 26.

ROTHBALLER, GERALD, South Bend, Ind.; Indiana University School of Dentistry, 1932; died March 23.

SHARP, FRANK ELLIOTT; Los Angeles, Calif., formerly of Port Huron, Mich.; University of Michigan School of Dentistry, 1903; died February 22; aged 57.

SHARP, WILLIAM VANCE, Stromsburg, Nebr.; died January 18; aged 78.

STOKES, ALBERT WALTER, San Francisco, Calif.; College of Physicians and Surgeons of San Francisco, 1905; died recently.

THORNBY, GLEN A., Capac, Mich.; died January 8.

TILTON, ASHER J., Lancaster, Pa.; Medico-Chirurgical College of Philadelphia, 1915; died recently; aged 49.

TUMMEL, ARTHUR M., Oak Park, Ill.; Chicago College of Dental Surgery, 1902; died December 15; aged 66.

WATTS, JAMES B., Springfield, Ill.; Northwestern University Dental School, 1898; died February 24; aged 65.

WELP, LAWRENCE W., Waterloo, Iowa; Chicago College of Dental Surgery, 1915; died February 18; aged 47.

WHITTAKER, JOHN F., Philadelphia, Pa.; Pennsylvania College of Dental Surgery, 1903; died February 1.

WILKIE, JAMES, Olympia, Wash.; North Pacific Dental College, 1919; died February 16; aged 58.

WILKINS, THOMAS ANDERSON, Gastonia, N. C.; University of Louisville, School of Dentistry, 1905; died November 20.

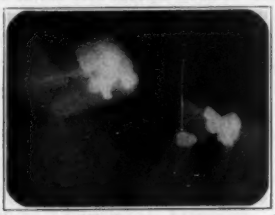
ZIEGLER, DANIEL H., Cleveland, Ohio; Western Reserve University School of Dentistry, 1899; died November 7; aged 70.

INCIDENTS OF PRACTICE

Value of Root-Canal Filling

By Nathan Peck, D.D.S., Bronx, N. Y.

The roentgenogram herewith tends to confirm the statement that a well-filled root canal will cause no pathosis. The picture shows a lower left second molar. The distal



Condition of filled root as compared to unfilled.

canal has been filled, while the mesial has not. The unfilled root is partially resorbed, whereas the filled root shows an intact lamina dura and no evidence of periapical disease.

4197 Park Avenue.

Supernumerary Teeth

By E. J. Conley, D.D.S., Lexington, Ky.

A girl, aged 13, had the deciduous upper central incisors in place and x-rays revealed

Five supernumerary teeth.

five supernumerary teeth. The patient was fully developed and had an excellent arch and normal alveolar development. All the other teeth were in place and in excellent condition.

405 Security Trust Building.

A Case of Distinct Tooth Fusion

By Maxwell E. Stone, D.D.S., Bloomfield, N. J.

A woman, aged 25, who reported for a mouth examination, had a cavity involving the pulp in what appeared to be a decidu-

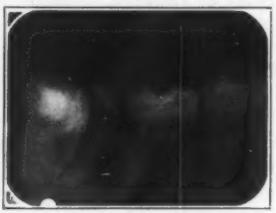


Fig. 1.—Third and second molars in reversed position.

Fig. 2.—Extracted reversed molars.

ous molar. The interesting feature of the anomaly was the reversed positions of the third mandibular molar and the second mandibular molar.

15 Grove Street.

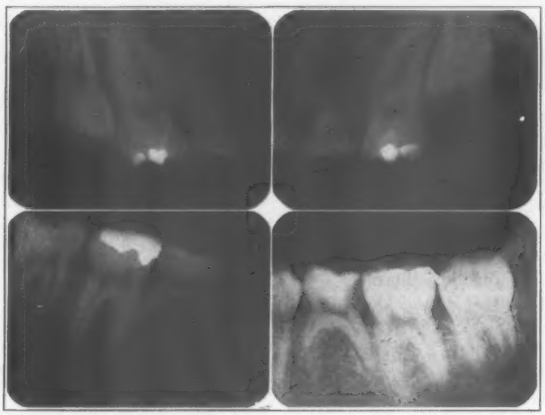
Importance of X-Ray Examination of Deciduous Teeth Before Treatment

By J. Bardin Goodman, D.D.S., Brooklyn, N. Y.

It is nothing new in dentistry to take x-ray pictures of children's teeth in examinations and especially before an extraction.

A girl, aged 14, was brought to the office

recently with a request that a lower left second deciduous molar tooth be removed. The patient still had three second deciduous molars.



Retention of three deciduous teeth to prevent malocclusion.

The father stated that the child was in severe pain and wished to have the tooth out without an examination.

An x-ray examination revealed that there were no second bicuspids present in the mouth and, from the x-ray pictures, it was possible to convince the father of the desirability of retaining this deciduous tooth if possible and also of retaining and observing the two other deciduous molar teeth, as their removal would cause malocclusion. The x-rays now reveal closing of the space and no upper right second bicuspid.

1509 Foster Avenue.

PRACTICE IN PARAGRAPHS

Treatment of Deep Periodontal Pockets—The following technic is useful in the treatment of teeth having deep periodontal pockets that do not respond to complete scaling, curetment, balancing the bite, diet and correct brushing habits.

The tooth or teeth are curetted thoroughly to the deepest part until smooth and clean. With a 3-5 per cent solution of chlorazene (chloramine T) in a periodontal syringe or hyposyringe having a thin long needle, the pocket is flushed out. This is repeated every second or third day for about two weeks, and thereafter once or twice a week until the pocket is closed and there is no more seepage of pus. I have used this technic in my practice and find it superior to any other method in use at the present time. —*A. D. Mollin, D.D.S., 353 Middle Neck Road, Great Neck, L. I.*

Curing Acrylics—Acrylics should be heated slowly. Thick cases can be kept at 70° C. for from one to two hours and then boiled, to prevent bubble formation, the monomer liquid, whose boiling point is 100° C., being given a chance to polymerize. If the case is heated quickly, the liquid boils inside the flask and forms bubbles.—*Alfred T. King, 185 N. Wabash Avenue, Chicago, Ill.*

CURRENT LITERATURE

Partial Hypoplasia of the Lower Jaw (Achondroplasia Partialis)

By KARL GOLDHAMER

THE author reports an unusual case of a non-inflammatory disease of the temporomandibular articulation in which the roentgenogram was the most valuable aid in diagnosis. The patient, a 20-year-old boy, had observed unequal movements of the right and left temporomandibular joints since early childhood. Clinically, there was a slight lateral displacement of the lower jaw. The roentgen rays revealed the reason for these symptoms. There was an abnormally small right condyle and ascending ramus. In the normal articulation, the left condyle covered an area of about 100 sq. mm., while the corresponding area on the right covered only 24. The outline of these parts, however, was normal. No evidence of inflammation or traumatic changes could be noted. Since the parts of the jaw affected corresponded to the areas which develop from the embryonic cartilage islands in that region, the author suggests that the deformity was due to a developmental deficiency in those cartilaginous parts. He therefore diagnosed this case of localized deficiency as achondroplasia partialis. Symptomatic treatment was all that was possible.—*Am. J. Roentgenol. & Rad. Therap.*, 45:563, April 1941.

HANNAH E. SILBERSTEIN.

Roentgenograms of the Mandibular Condyle and Zygomatic Arch

By FREDERICK R. MCGRAIL and JOSEPH A. DOHERTY

AN intra-oral roentgenologic technic for obtaining information on fractures of the mandibular condyle and zygomatic arch is advocated by the authors in this article. They stress the need of such a technic for obtaining more information on this type of fracture. In single exposure surveys of the mandible, the existence of fractures can be demonstrated, but accuracy in determining the location is not possible.

Two earlier methods for distinguishing fractures of the condyle and zygomatic arch are reviewed. By using the present technic, good results in examination of the neck of the condyle can be obtained by directing the central rays through the opposite sigmoid notch at right angles to the condylar process. For obtaining an accurate impression of the zygomatic arch, the authors place an occlusal film within the mouth with the emulsion side toward the maxilla. They slide it as far out in the cheek on the side of injury as possible. The tube is placed above the head, avoiding the convex portion of the frontal bone. The central rays are directed at right angles to the film. This procedure, they say, is applicable only where the manipulation of placing a film in the mouth would not be harmful to the patient.—*Am. J. Roentgenol. & Rad. Therap.*, 45:637, April 1941.

HANNAH E. SILBERSTEIN.

Dental Caries and Permanent Tooth Extraction: A Study by Age, Sex, and Location of the Incidence of First Permanent Molar Extraction in 8,677 School Children

By VIRGIL D. CHEYNE and CHARLES L. DRAIN

A STUDY of the first permanent molar is important in investigations concerned with dental caries because the early appearance of this tooth in the mouth makes it one of the most vulnerable teeth of the permanent dentition. In fact, caries leading to pulpal involvement with subsequent extraction is so common that it is permissible to regard the loss of this tooth as indicative of the degree to which a child is susceptible to caries.

Treatment of data concerned with the loss of the permanent teeth of children is considered in this paper. Emphasis is placed upon the loss of the first permanent molar and evidence is presented as to how it may constitute the cause of many of our orthodontic problems. The figures presented are divided according to sex and location of the

tooth in the mouth. The records of 4,239 boys and 4,438 girls, ranging in age from 7 to 14 years (inclusive), were examined. The charts reviewed included only those of patients with teeth beyond conservative treatment and marked for extraction at the time of examination. This method served to establish the rate of loss of the teeth for each of the age groups, as well as conveying information on cumulative loss. Related data in the literature were reviewed and correlated whenever possible. The findings were evaluated statistically.

The results of the study show that there was no difference demonstrable for loss between the right and left sides of the mouth for either sex. The loss of mandibular teeth for each age group in both sexes was consistently higher than loss of the maxillary. Although the loss of maxillary molars was greater in girls, the total extractions were not statistically different from that in boys. The average cumulative loss of molars per hundred patients for all ages studied was nearly 50 per cent before the children reached the age of 15 years. Furthermore, this tooth constituted 88 per cent of all teeth lost, and of the number, the lower first molars alone contributed 65.8 per cent. Of a total assumed 36,044 first and second premolars studied, only 0.7 per cent were found to be destroyed.

The conclusions are that the greatest damage to the permanent dentition takes place at a relatively early age in life. This is largely caused by caries and loss of the first permanent molar. The value of this study in establishing a "base-line" for caries susceptibility has been stressed.—*J. D. Res.*, 19: 571, December 1940.

HANNAH H. SILBERSTEIN.

Lesions of the Oral Mucosa Treated with Specific Vitamins

By DAVID WEISBERGER

MANY of the changes that occur in the mucous membranes of the mouth in deficiency states have been described in the literature. For the most part, individual reports are not concerned with specific avitaminosis. This is especially true of the B group. This paper considers specific deficiencies of nicotinic acid, thiamin and riboflavin. In the cases observed by the author, the changes most frequently associated with a deficiency of nicotinic acid are a profound necrotic gingivitis and necrotic sloughing of areas in the buccal mucosa. The tongue appears normal in all cases. The characteristic symptom of a lack of thiamin is the development of pinpoint vesicles on the buccal mucosa, under the tongue or on the palate. Lesions caused by riboflavin deficiency occur on the tongue and occasionally coexist with a conjunctivitis. The changes consist of a primary coating followed by a patchy desquamation, usually oval. The center is atrophic and the periphery is raised. In all patients, with the exception of some in the riboflavin group, oral medication with the vitamin in question was satisfactory. In the riboflavin group, there was a better response to intravenous injection.—*Am. J. Orthodontics*, 27: 125, March 1941.

VIRGIL D. CHEYNE.

Lipoma of the Tongue

By BELA HALPERT

LIPOMA of the tongue is very rare, there being less than fifty such tumors on record. These vary in size, the largest one reported being 11 by 9 by 7 cm., and weighing 320 gm. The growth is composed of lobules of adipose tissue with loose connective tissue septums containing small blood vessels.

The growth occurred almost twice as frequently in men as in women in the fifty cases on record. There is no available information on race incidence, although this is the first case of such a neoplasm to be reported in a negro. The lipoma appeared in a 55-year-old woman. The spherical mass had been present for ten years and it was not painful nor did it bleed. The growth was covered with an intact mucosa and was moderately firm. Excision disclosed the lobules of adipose tissue with a delicate connective tissue capsule surrounding it.—*Arch. Path.*, 31:510, April 1941.

GEORGE J. STRAGAND.

Evaluation of Convalescent Serum in the Prevention of Mumps

By JOSEPH H. LYDAY

RECENT reports on the use of convalescent serum in preventing mumps have been very favorable. The experience of this author in treating patients prior to an endemic occur-

rence of the disease in the Children's Hospital of the University of Colorado School of Medicine suggests that, while serum is of definite value, it should not be depended on. In the data presented, there were eleven failures to prevent the disease after treating eighty-six exposed susceptible persons. Six of the failures occurred in children who had been reexposed to the disease after attaining an apparent immunity to the first exposure. The data indicate that 10 cc. of convalescent mumps serum gives a passive immunity of short duration in a high percentage of cases, but that it seems necessary to repeat the injection of serum after each exposure to the disease.—*J. Pediatrics,* 18:473, April 1941.

VIRGIL D. CHEYNE.

Treatment of Lichen Planus with Vitamin B Complex

By J. F. BURGESS

LICHEN planus, a cutaneous reaction, occurs in a variety of forms and degrees of intensification. From a clinical standpoint, the primary lesion is a small, violaceous, polygonal papule, with a plateau-like surface which reflects the rays of light, and covered, not infrequently, with fine striae. Histologically, lichen planus resembles a specific inflammatory eruption with a characteristic bandlike infiltration of cells in the upper part of the true skin, over which there is a hyperplasia of some elements of the epidermis. It occurs in acute and chronic forms. The localized character is sometimes replaced by a generalized involvement of a large part of the body surface, including the mucous membranes. It may involve only the glabrous skin, or it may specifically affect the pilosebaceous orifices.

Etiologic factors are not clearly understood. Clinical observation suggests etiologic theories including parasitic, microbic and toxic factors. The author tabulates fifteen cases that seem to bear out the view long held that there is an important relationship between neurologic and dermatologic reactions in this disease. A psychoneurosis caused by mental stress and worry leads to an outbreak of lichen planus.

In the author's work, a rapid response was obtained from the use of vitamin B complex in the acute cases. The response was slower in the chronic cases, which were characterized by thickening of the skin. Failure to relieve the mental unrest and perturbation of the patients seemed to interfere seriously with the effect of the vitamin B complex therapy. The author was unable to attribute increased effectiveness to any of the individual vitamin constituents of B complex and therefore recommends the administration of vitamin B complex as a whole as the more effective method of treatment.—*Canad. M. A. J.,* 44:120, February 1941.

HARRY J. HEALEY.

Effects of Thyroidectomy and Thyroid Stimulation on Growing Permanent Dentition of Rhesus Monkeys

By DANIEL E. ZISKIN and EDMUND APPLEBAUM

THE relation of the thyroid gland secretion to rates of dentin apposition and calcification was studied in a small number of animals under various experimental conditions. Five young female monkeys were thyroidectomized, two were thyroidectomized and castrated and three were not operated on, but received 80 mg. per day of anterior pituitary extract containing the thyrotropic hormone. In each operation, the parathyroid glands were carefully reimplanted. The variations in growth rate of the dentin were measured by means of alizarin lines from injections given during a control preexperimental period and later during the experimental periods. The experimental periods varied from ten to 100 days. Grenz-ray studies were made to check the degree of calcification. In the thyroidectomized animals, dentin apposition was retarded from 56 to 90 per cent. There was also disturbance in calcification in the postoperative period as indicated by the increased width of the zone of predentin, and the relative transparency to the grenz ray of the newly formed dentin. The castrated-thyroidectomized animals showed similar results unaltered by treatment with estrogenic hormone. On the other hand, those animals treated with the thyrotropic hormone preparation showed slight increases in apposition rate, but a normal degree of calcification in the experimental period. Owing to the toxic effects of the extract, the experimental periods were somewhat short.

Although the number of experimental cases is small, there are indications that the

thyroid gland plays some rôle in dentin development.—*J. D. Res.*, 20:21, February 1941.

HANNAH E. SILBERSTEIN.

Effect of Hibernation on Rate of Eruption and Dentin Apposition in Ground Squirrel Incisor

By BERNARD G. SARNAT and WALTER E. HOOK

USING nine control and twenty-six experimental thirteen-lined ground squirrels, hibernation was induced in the experimental group by withholding food and water for two days and then placing the animals in a dark constant-temperature room at 2 to 5° C. A transverse notch at the labiogingival border made possible the measurement of the rate of eruption. The alizarine red S method of determining dentin apposition was employed. Measurements indicated that hibernation produced marked retardation in the eruption and dentin deposition of both upper and lower incisors in approximate proportion to the number of days of hibernation.—*Proc. Soc. Exper. Biol. & Med.*, 36:685, April 1941.

H. B. MCCAULEY.

Review of Malignant Melanoma of the Mouth: Report of a Case

By HAMILTON BAXTER

IN this review of malignant melanoma of the mouth, it was found that fifty-four cases had been reported in the literature, thirty-five cases in males and fourteen in females. The average age was 46 years and 68 per cent occurred after 40 years of age. The oldest patient was 84 years and the youngest 2 months. There are many theories as to the etiology of these growths. As in other parts of the body, embryologic trauma and irritation have been suggested as the probable cause. The majority of these oral tumors originate on the upper alveolar ridge or palate, 93 per cent of the reported cases occurring in this location. It is suggested that this is attributable to the complicated embryologic development of the maxilla and to the inclusion in it of cells that are capable of producing melanin; and that, later in life, some stimulus may cause these cells to undergo neoplastic infiltration.

The diagnosis is made upon the color of the growth, which is characteristic of the cells, and the history of the case. These tumors offer a poor prognosis, for, in many cases, metastasis takes place before the growth is discovered. The only hope is early recognition, wide destruction of the primary lesion and block dissection of the lymph glands that drain the area. The case reported follows the general trend of other cases.

The most common sign of malignant melanoma is the presence of a rapidly growing "blackberry" tumor in the mouth.—*Am. J. Surg.*, 51:379-386, February 1941.

JAMES T. GINN.

Structure of the Bones of the Face in Relationship to Fractures and Other Aspects of Facial Injuries

By W. WARWICK JAMES and B. W. FICKLING

AN analysis of fractures of the bones of the face reveals the infrequency with which the line of fracture involves the tooth socket. Bone density, arrangement of bone trabeculae, conical structure of the tooth socket, arrangement of curves, buttresses and tie-bars are some of the important factors in the relationship of fractures of the bones of the face to the tooth socket. According to a classification by Fortin, the three types of fracture of the bones of the face involve the three lines of least resistance.—*Proc. Roy. Soc. Med.*, 34:205, 1940.

A. PEARSON.

Relation of Dental Caries in City Children to Sex, Age and Environment

By BION R. EAST

THIS report is based upon a study of 528,842 white children in 156 cities in the United States. Each city in this group has a population of at least 10,000 and, in fifty-five of these cities, the population is more than 100,000. Evidence is presented that the amount of dental decay in the teeth of children is related to the amount of sunshine available in the city in which they reside. The more favorable the conditions for the exposure of the skin to the vitamin D-producing rays of the sun, the less the dental decay. These findings are further evidence that the caries incidence in chil-

dren is lowered when they are regularly fed vitamin D. It was found that the larger the city and the more northerly its location, the greater the need for the administration of vitamin D to promote resistance to caries. Latitude has a more profound effect on caries incidence among city than among rural children. It is suggested that this is due, in part at least, to the interference of buildings with the passage of direct sunlight to the street.—*Am. J. Dis. Child.*, 61:494-517, March 1941.

JAMES T. GINN.

Temporomandibular Joint

By CLARENCE E. SHEETS, JR.

UNTIL rather recently, the joint proper has been considered by both the medical and the dental profession as lying somewhat outside its respective domains, but correlation of knowledge now makes it reasonable for the physician to consider it from the systemic angle, and the dentist as regards local mouth conditions as etiologic factors in the disorder.

It is concluded that the temporomandibular joint should be considered more routinely, with a standardized roentgen technic. The majority of abnormalities, if recognized, can be corrected by the general practitioner, but it is important to be able to recognize the cases that should be placed in more qualified hands.—*Mil. Surgeon*, 88:529, May 1941.

J. F. STRIEGEL.

Oral Cysts of Dental Origin

By A. H. YANDO and CARL A. SCHLACK

THE authors discuss the etiology and diagnosis of oral cysts of dental origin: (1) dentoperiosteal cysts, or root and radicular cysts; (2) dentigerous, or tooth-bearing, cysts; (3) ameloblastoma, and (4) cysts of pseudodental origin, or median anterior maxillary cysts. Since the most active parts of cysts are principally the epithelial tissue, its derivation and the circumstances under which it proliferates are of great importance. The epithelium found in dental cysts is derived from the dentogingival lamina and the enamel organ. The median anterior maxillary cysts are discussed because it is sometimes difficult to differentiate them from those of dental origin owing to their close approximation to the teeth.

It is difficult to determine clinically or roentgenologically the various types of cysts that occur in the oral cavity. This is especially true in the early stages of their development. It is suggested that all tissue removed from about the roots of teeth or in other locations of the jaw be studied microscopically, since this is the most accurate method of diagnosis.—*U. S. Navy M. Bull.*, 39:22-26, January 1941.

JAMES T. GINN.

Partial Anonychia (Recessive) with Hypertrophy of the Gums and Multiple Abnormalities of the Osseous System: Report of a Case

By N. M. JACOBY

A 2½-YEAR-OLD patient with delayed dentition and abnormalities of hands and feet had no unusual family or personal history. Examination revealed slight hypertelorism of the face and bulging gums, suggesting a mental deficiency not confirmed by mental tests. Only the lower incisors were erupted, but x-ray examination shows that teeth are present in normal numbers. Almost all the toe nails and several finger nails were absent.

Routine physical examination revealed no systemic disorders or abnormalities. The case appears to be a combination of two extremely rare congenital abnormalities with additional defects of the bones.—*Guys' Hosp. Rep.*, 90:34, No. 1, 1940-1941.

J. F. STRIEGEL.

Tumors of the Upper Jaw, Particularly Tumors Related to the Sinuses

By CARL W. WALDRON

THE upper jaw may be the site of any of the tumors that involve bone as well as cysts and calcified tumors of dental origin. The classification of cysts and tumors of dental origin given is based upon a study made by the committee of the British Dental Association. Owing to the close proximity of many of these tumors to the sinuses, great skill is required in diagnosis and in methods of treatment. Careful clinical and roentgenographic examination is essential to determine the position and extent of the tumor. The treatment consists of complete enucleation by surgery. If the cystic tumor is large and there is reason to believe that complete enucleation will result in extensive perfora-

tions into the nose or maxillary sinus, the Partsch operation is advised.

The tumors involving the bones are classified according to the various modifications of the Codman registry nomenclature of the American College of Surgeons. These tumors may be benign or extremely malignant. The benign tumors of this group may be treated by surgery, for their complete removal is usually effective in eradicating these tumors. Treatment of the malignant tumors of the upper jaw is more difficult, and an important factor in dealing with these tumors is early diagnosis. The means of treatment is surgical diathermy, supplemented by irradiation.—*Surg., Gynec. & Obst.*, 72:503-511, February 15, 1941.

JAMES T. GINN.

Aphthous Pharyngitis

By B. B. BREESE

THE clinical picture of this disease is not described in the standard textbook, but is covered very well in this article. The condition is characterized by a sudden onset of headache, malaise and sore throat and temperature. Most significant is the appearance of one or more yellowish white, slightly raised vesicles, 1 to 2 mm. in diameter, with an intense red areola, and appearing on the tonsillar pillars and the soft palate. The temperature usually rises from 103 to 104° F. and the fever lasts only about twenty-four hours. The lesions in the mouth last from five to ten days, but give rise to few complaints. The incubation period of this contagious disease is about three days and the cause is unknown.—*Am. J. Dis. Child.*, **61**:4, April 1941.

E. C. WOODS.

Experimental Human Scurvy

By F. W. FOX

IN an attempt to determine how long it takes for a healthy adult to become scorbutic when fed on a diet otherwise fully adequate but entirely devoid of vitamin C, Crandon set to work on a plan prepared by the Harvard School of Medicine (1940). He placed himself on such a diet for six months, with these results: 1. The physical findings remained negative for four months, then there were loss of weight, a lowered metabolic rate and weakness. 2. The plasma ascorbutic acid level fell to zero in forty-one days and remained at this level for thirteen weeks before clinical scurvy was manifest. 3. Resistance to infection remained normal throughout the experiment. 4. The first clinical evidence of scurvy, roughness of the skin and keratosed papular eruptions, appeared after 134 days. 5. The first evidence of petechial hemorrhage appeared after 161 days. 6. The gums were normal for five months, then, three weeks after the advent of clinical scurvy, they appeared boggy, but otherwise normal. 7. Roentgenograms of the teeth revealed occasional interruption of the lamina dura at that time. 8. All symptoms disappeared on injection of ascorbutic acid.—*Brit. M. J.*, 1:311, March 1, 1941.

H. B. MCCAULEY.

Lower Jaw: Double Condyles

By ALES HRDLICKA

IN an extensive study of the lower jaw, an unreported anomaly was noted in a few of the mandibles. Twelve cases were found in which there were two distinct heads of the condyloid process, and, in eleven cases, a deep groove was noted in the head of the condyle, indicating a tendency to form two separate heads. There is nothing in the development of this bone to account for this anomaly. The only possibility presented was that a blood vessel passed through the articular cartilage and formation of this groove resulted. If this is the case, it is an accidental anomaly and may be classified as benign. There was no relationship to race or sex noted, and in most cases only one side was found to be involved.—*Am. J. Phys. Anthropol.*, **28**:75, March 1941.

E. C. WOODS.

Importance of the Histologic Picture of Osteomyelitis of the Jaws Following Extraction of Teeth for Treatment

By WILLIAM H. BAUER

AFTER reviewing the literature on the healing of extraction wounds, the author presents the histologic changes in jaws, as obtained at necropsy, from four persons who died as a result of tooth extraction. These studies indicate that osteomyelitis is much more common in the mandible than in the maxilla. The presence in the maxilla of

the sinus and nasal cavities, which are lined with highly resistant epithelium, may be an important factor in limiting infection in these areas. Certainly the mandibular canal is a ready pathway to infection; which enters the canal, involves the inferior alveolar nerve and causes a perineuritis, which may lead to complete destruction of the nerve and involvement of the entire mandible.

Histologic studies also explain how slowly the demarcation for the dead bone develops and how patiently one must wait for its sequestration or spontaneous elimination.—*Am. J. Orthodontics,* 26:150, February 1940.

M. K. HINE.

Practical Points in the Diagnosis and Treatment of Fractures of the Jaws

By JOSEPH A. DOHERTY

THERE has been an increasing number of fractures of the jaws during the past two decades. Because of the danger of complications, the author advises that a complete clinical and roentgenographic study be made of all cases. The mandible is more often fractured than the maxilla and there is serious danger of displacement of the parts because of muscle pull. A treatment is described which has for its aim the overcoming of muscular pull and, at the same time, permitting the parts to remain in proper position. Normal occlusion should be reestablished as soon as possible after the accident, and maintained throughout the treatment. It is also necessary to maintain oral hygiene and to keep up the patient's general health by means of an adequate diet. Osteomyelitis and malunion can often be avoided by the maintenance of drainage of all supporting areas.—*Surg., Gynec. & Obst.,* 72:96-98, January 1941.

JAMES T. GINN.

Osteo-Arthritis Deformans of the Temporomandibular Joint

By WILLIAM H. BAUER

MICROSCOPIC examinations were made of forty-two human temporomandibular joints from persons 3 months to 81 years of age. The author describes the normal joint in detail and reports his findings. Traumatic changes involving primarily the cartilage of the condyle, the articular tubercle, the mandibular fossa and the disk structure were noted in most of the joints studied.

The author believed that the lesions resulted from impairment of function of the involved joint, due to loss of teeth or to an external injury. All disturbances resulted indirectly in a decrease or loss of elasticity of the cartilage, the main function of which is the protection of the subchondral bone against abnormal stresses. The cartilage showed cracks and fissures, and the cartilage cells demonstrated various types of degenerative changes or an overgrowth of the cartilage cells. The disk showed all degenerative changes up to complete destruction.

Five of the cases were studied before death. Comparison of the clinical histories with the microscopic findings proved that, owing to the accommodation of this joint to pathologic changes, even severe changes were not associated with marked subjective symptoms.—*Am. J. Path.,* 17:129, January 1941.

M. K. HINE.

Magnesium Determinations on All the Dentin from Sound and Carious Teeth

By HELEN TEFFT, ETHEL L. FRENCH and HAROLD C. HODGE

SEVERAL investigators have reported a higher magnesium content in carious teeth than in sound teeth. Since no comparison has been made on dentin and enamel separately, this study was conducted to determine the magnesium percentages of the dentin in carious and sound teeth. Analytic data for the percentage of magnesium in the dentin of forty-nine teeth, extracted from three patients, were listed, with a caries classification for each tooth.

The teeth from the least carious mouth had an average magnesium content of 1.16 per cent as compared with 1.24 per cent in the most carious mouth. In the case of two of the patients, the magnesium content increased uniformly with carious conditions, but the average magnesium content in the teeth of the third patient was constant, regardless of the degree of caries. These data might support the idea that magnesium increases during caries destruction; but there is the possibility that the carious teeth had more magnesium laid down during calcification.—*J. D. Res.,* 20:45, February 1941.

RALPH W. PHILLIPS.

ANNOUNCEMENTS

ANNOUNCEMENTS must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

CALENDAR OF MEETINGS

AMERICAN ACADEMY OF PERIODONTOLOGY, Houston, Texas, October 23-25.

AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTS, Houston, Texas, October 27-28.

AMERICAN DENTAL ASSISTANTS ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN DENTAL ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION, Houston, Texas, October 27-31.

AMERICAN PUBLIC HEALTH ASSOCIATION, Atlantic City, N. J., October 14-17.

ASSOCIATION OF FRENCH SPEAKING DENTISTS OF NORTH AMERICA, Quebec, Canada, June 5-7.

DISTRICT OF COLUMBIA DENTAL SOCIETY, second and fourth Tuesdays in each month from October to June at the United States Public Health Service Auditorium, Washington.

LATIN AMERICAN CONGRESS FOR PLASTIC SURGERY, Rio de Janeiro and S. Paulo, July 6-12.

MEXICAN ORTHODONTISTS ASSOCIATION, Mexico City, June 23-28.

NATIONAL DENTAL ASSOCIATION, Richmond, Va., August 11-15.

NORTHWESTERN UNIVERSITY DENTAL SCHOOL ALUMNI ASSOCIATION, Chicago, Ill., June 11-12.

ODONTOLOGICAL SOCIETY OF WESTERN PENNSYLVANIA, Pittsburgh, November 11-13.

PACIFIC COAST DENTAL CONFERENCE, Portland, Ore., July 7-11.

SOUTHERN SOCIETY OF ORTHODONTISTS, Raleigh, N. C., September 29-30.

WESTERN RESERVE DENTAL ALUMNI ASSOCIATION, Cleveland, Ohio, June 9.

STATE SOCIETIES

June

Colorado, at Colorado Springs (19-21)
Maine, at Portland (26-28)
Mississippi, at Biloxi (9-11)
Nevada, at Reno (7)
New Hampshire, at New London (22-24)
New Mexico, at Albuquerque
Pennsylvania, at Bedford (3-5)
South Dakota, at Rapid City (15-17)
Utah, at Salt Lake City (26-28)

July

Washington, at Portland

September

Southern California, at Los Angeles (8-10)
Hawaii, at Honolulu

November

Ohio, at Columbus

STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, June 23. W. A. Wood, Merchants Nat'l Bank Bldg., Mobile, Secretary.

Arizona, at Phoenix, July 9-12. R. K. Trueblood, 25 N. Second St., Glendale, Secretary.

Arkansas, at Little Rock, June 23-26. Clarence W. Koch, 817 Donaghey Bldg., Little Rock, Secretary.

California, at Los Angeles, June 16. Kenneth I. Nesbitt, 515 Van Ness Ave., San Francisco, Secretary.

Connecticut, at Hartford, June 24-28. Clarence G. Brooks, New London, Recorder.

Delaware, at Wilmington, June 17-20. Charles R. Jefferis, Medical Arts Bldg., Wilmington, Secretary.

Florida, at Jacksonville, June 23-27. H. B. Pattishall, 351 St. James Bldg., Jacksonville, Secretary.

Georgia, at Atlanta, June 9-12. R. C. Coleman, Room 11, State Capitol, Atlanta, Secretary.

Indiana, at Indianapolis, June 3-7. D. Gordon Lamb, 819 Chamber of Commerce Bldg., Indianapolis, Secretary.

Kentucky, at Louisville, June 10-13. Leon

M. Childers, 1312 First Nat'l Bank Bldg., Lexington, Secretary.

Louisiana, at New Orleans, June 9-14. B. J. LaCour, Welsh, Secretary.

Maine, at Augusta, June 23-25. Carl W. Maxfield, 31 Central St., Bangor, Secretary.

Massachusetts, June 9-12. Francis M. Cahill, State House, Boston, Secretary.

Mississippi, at Jackson, June 17. G. L. Clement, Pontotoc, Secretary.

Montana, at Helena, July 14. Leonard A. Jenkin, 401 Ford Bldg., Great Falls, Secretary.

Nebraska, at Omaha and Lincoln, June 16-21. Henry A. Merchant, Medical Arts Bldg., Omaha, Secretary.

New Hampshire, at Manchester, June 12-14. Otis M. Littlefield, 913 Elm St., Manchester, Secretary.

New Jersey, June 23-28. W. A. Wilson, 148 W. State St., Trenton, Secretary.

New Mexico, at Santa Fe, June 23-26. J. J. Clarke, Sr., Artesia, Secretary.

North Carolina, at Raleigh, June 23. Wilbert Jackson, Rich Bldg., Clinton, Secretary.

North Dakota, at Fargo, July 7-10. L. I. Gilbert, 401 Black Bldg., Fargo, Secretary.

Ohio, at Columbus, June 23. Earl D. Lowry, 79 E. State St., Columbus, Secretary.

Oklahoma, at Oklahoma City, June 16-19. W. T. Longwell, First National Bank Bldg., Frederick, Secretary.

Oregon, at Portland, June 9-13. Arthur F. Weeks, Selling Bldg., Portland, Secretary.

Pennsylvania, at Philadelphia and Pittsburgh, June 17-21. Reuben E. V. Miller, 61 N. Third St., Easton, Secretary.

South Dakota, at Rapid City, June 18-21. C. H. Boyden, Mitchell, Secretary.

Texas, at Dallas, June 16-20. B. Carl Holden, Nixon Bldg., Corpus Christi, Secretary.

Vermont, at Montpelier, June 23-25. C. I. Taggart, Burlington, Secretary.

Virginia, at Richmond, June 10. John M. Hughes, 715 Medical Arts Bldg., Richmond, Secretary.

West Virginia, at Charleston, June 23. Henry C. Hill, Charleston, Secretary.

Wisconsin, at Milwaukee, June 16-20. S. F. Donovan, Tomah, Secretary.

AMERICAN ACADEMY OF PERIODONTOLOGY

THE American Academy of Periodontology will hold its twenty-eighth annual meeting at the Lamar Hotel, Houston, Texas, October 23-25.

RAYMOND E. JOHNSON, *Secretary,*
824 Lowry Medical Arts Bldg.,
St. Paul, Minn.

AMERICAN ASSOCIATION OF PUBLIC HEALTH DENTISTS

THE annual meeting of the American Association of Public Health Dentists will be held in the Lamar Hotel, Houston, Texas, October 27-28.

FRANK C. CADY, *Secretary,*
U. S. Public Health Service,
Washington, D. C.

AMERICAN DENTAL ASSISTANTS ASSOCIATION

THE seventeenth annual session of the American Dental Assistants Association will be held in Houston, Texas, October 27-31. For further information, address

AILEEN M. FERGUSON,
General Secretary,
709 Centre St.,
Jamaica Plain, Mass.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION

THE eighteenth annual meeting of the American Dental Hygienists' Association will be held in Houston, Texas, October 27-31. Headquarters, Lamar Hotel.

A. REBEKAH FISK, *Secretary,*
General Dispensary, U. S. Army,
Washington, D. C.

AMERICAN DENTAL HYGIENISTS' ASSOCIATION EMPLOYMENT BUREAU

THE American Dental Hygienists' Association announces the establishment of a national employment bureau. A general chairman, assisted by a registrar in each state in which the dental hygienist is licensed to practice, will serve as the employment bureau committee. The purpose of the bureau is to assist the dental hygienist in securing a position, as well as giving every possible aid to the dentist who wishes to secure the services of a qualified hygienist. Mrs. Lura E. Swanson, 2019 Elbur Ave., Lakewood, Ohio, is the general chairman.

AMERICAN DENTAL SOCIETY OF THE ARGENTINE REPUBLIC

THE officers of the American Dental Society of the Argentine Republic are as follows: president, Rigoberto Blanco; vice president, S. W. Damon; secretary, George French; treasurer, Charles M. Smart; editor, H. L. Prettyman; executive council: J. I. O'Farrell, M. V. Tidball, Fred E. Judson. C. F. Valenzuela is an honorary member.

GEORGE FRENCH, *Secretary,*
Buenos Aires,
Maipú 39.

AMERICAN PUBLIC HEALTH ASSOCIATION

THE seventieth annual meeting of the American Public Health Association will be held in Atlantic City, N. J., October 14-17. Headquarters, Convention Hall; residence headquarters, Hotel Traymore.

WILLIMINA RAYNE WALSH,
Associate Secretary,
1790 Broadway,
New York, N. Y.

ASSOCIATION OF FRENCH SPEAKING DENTISTS OF NORTH AMERICA

THE Association of French Speaking Dentists of North America will hold its annual convention at Chateau Frontenac, Quebec, Canada, June 5-7.

VIGER PLAMONDON, *Secretary,*
606 Rue St. Jean,
Quebec.

LATIN AMERICAN CONGRESS FOR PLASTIC SURGERY

THE first Latin American Congress for Plastic Surgery will be held in Rio de Janeiro and S. Paulo, July 6-12.

ANTONIO PRUDENTE, *Chairman.*

MEXICAN ORTHODONTISTS ASSOCIATION

THE Thirđ Medicodental Convention of the Mexican Orthodontists Association will be held in Mexico City, June 23-28, at the School of Dentistry of the National University of Mexico. Members of the American Dental Association are welcome.

S. FASTLIGHT, *Secretary,*
Madero 40,
Mexico City.

NATIONAL DENTAL ASSOCIATION

THE National Dental Association will convene for the twenty-eighth annual session August 11-15, in Richmond, Va. For further information, address

J. A. JACKSON, *Secretary,*
Charlottesville, Va.

NORTHWESTERN UNIVERSITY DENTAL SCHOOL ALUMNI ASSOCIATION

NORTHWESTERN University Dental School Alumni Association will hold its annual homecoming clinic and golf day, June 11-12. June 11 will be spent in the Ward Memorial Building, 311 East Chicago Ave., 9 a.m. to 5 p.m.

GEORGE W. TEUSCHER, *Secretary,*
311 E. Chicago Ave.,
Chicago, Ill.

ODONTOLOGICAL SOCIETY OF WESTERN PENNSYLVANIA

THE annual meeting of the Odontological Society of Western Pennsylvania will be held November 11-13 at the William Penn Hotel, Pittsburgh.

W. EARLE CRAIG, *Secretary,*
206 Jenkins Bldg.,
Pittsburgh.

PACIFIC COAST DENTAL CONFERENCE

THE sixth triennial Pacific Coast Dental Conference will be held in Portland, Ore., July 7-11.

A. F. WEEKS, *Secretary,*
Selling Bldg.,
Portland, Ore.

SOUTHERN SOCIETY OF ORTHODONTISTS

THE next meeting of the Southern Society of Orthodontists will be held in Raleigh, N. C., September 29-30.

T. C. SPARKS, *Secretary,*
Medical Arts Bldg.,
Columbia, S. C.

WESTERN RESERVE DENTAL ALUMNI ASSOCIATION

THE Western Reserve Dental Alumni Association announces its annual Alumni Day at the School of Dentistry, June 9, with

dinner and class reunion at the Mid Day Club, 6:30 p.m.

JOSEPH R. GOULD,
630 Rose Bldg.,
Cleveland, Ohio.

SOUTHERN CALIFORNIA STATE DENTAL ASSOCIATION

THE next annual meeting of the Southern California State Dental Association will be held September 8-10 at the Los Angeles Biltmore Hotel.

FRANCIS J. CONLEY, *Secretary,*
804 Professional Bldg.,
Los Angeles.

NEW HAMPSHIRE DENTAL SOCIETY

THE next meeting of the New Hampshire Dental Society will be held June 22-24, at Soo-Nipi Park Lodge, New London.

FLOYD E. WILLIAMS, *Secretary,*
814 Elm St.,
Manchester.

PENNSYLVANIA STATE DENTAL SOCIETY

THE seventy-third annual meeting of the Pennsylvania State Dental Society will be held at the Bedford Spring Hotel, Bedford, June 3-5.

C. J. HOLLISTER,
Executive Secretary,
217 State St.,
Harrisburg.

SOUTH DAKOTA STATE DENTAL SOCIETY

THE fifty-ninth annual session of the South Dakota Dental Society will be held at Rapid City in the Black Hills, June 15-17.

ERNEST W. ELMEN, *Secretary,*
Sioux Falls.

BOARD OF DENTAL EXAMINERS OF ALABAMA

THE Board of Dental Examiners of Alabama will conduct its next annual dental examination beginning June 23, in Birmingham. All credentials must be filed with the secretary at least two weeks in advance of the examination. Address all correspondence to

W. A. WOOD, *Secretary,*
Merchants Nat'l Bank Bldg.,
Mobile.

ARIZONA STATE DENTAL BOARD

THE Arizona State Board of Dental Examiners will hold its annual examination of applicants for license to practice dentistry in Arizona at Phoenix, July 9-12. All application blanks and fees must be in the hands of the secretary at least fifteen days prior to the date of the examination. For application blanks and other information, address

R. K. TRUEBLOOD, *Secretary,*
25 N. Second Ave.,
Glendale.

ARKANSAS STATE BOARD OF DENTAL EXAMINERS

THE Arkansas State Board of Dental Examiners will conduct the next examination of applicants for dental licensure at Little Rock, June 23-26. All applications must be filed with the secretary not later than June 10.

CLARENCE W. KOCH, *Secretary,*
817 Donaghey Bldg.,
Little Rock.

CONNECTICUT DENTAL COMMISSION

THE Connecticut Dental Commission will meet in Hartford, June 24-28, for the examination of applicants for license to practice dentistry and dental hygiene and to transact any other business proper to come before it. Applications must be in the hands of the recorder at least ten days before the meeting. For application blanks and further information, apply to

CLARENCE G. BROOKS, *Recorder,*
New London.

DELAWARE STATE BOARD OF DENTAL EXAMINERS

THE examination of dental and oral hygienist candidates will be held at the Delaware Hospital, Wilmington, June 17-20.

CHARLES R. JEFFERIS, *Secretary,*
Medical Arts Bldg.,
Wilmington.

FLORIDA STATE BOARD OF DENTAL EXAMINERS

THE Florida State Board of Dental Examiners will hold its annual examination of applicants for license to practice dentistry and dental hygiene in Florida at Jacksonville in the Seminole Hotel, June 23-27. Preliminary applications must be filed by April 23. Final application for examinations

in dentistry and in dental hygiene must be complete by May 23. Address all communications to

H. B. PATTISHALL, *Secretary,*
351 St. James Bldg.,
Jacksonville.

BOARD OF DENTAL EXAMINERS OF GEORGIA

THE Georgia Board of Dental Examiners will meet June 9-12 at the State Capitol. For application blanks, address

R. C. COLEMAN, *Joint Secretary,*
Room 111, State Capitol,
Atlanta.

INDIANA STATE BOARD OF DENTAL EXAMINERS

THE next examination for licensure of the Indiana State Board of Dental Examiners will be held in Indianapolis beginning June 3 and continuing four days. All applications, fees and credentials positively must be in the hands of the secretary not later than ten days prior to the beginning of the examinations. For applications, instructions and other information, address

D. GORDON LAMB, *Secretary,*
819 Chamber of Commerce Bldg.,
Indianapolis.

KENTUCKY STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the Kentucky State Board of Dental Examiners will be held June 10-13, at the University of Louisville, Dental School, Louisville. Dentists having graduated prior to 1941 and desiring to stand examination before this board must have filed applications, complete with full information requested, at this office not later than April 10. Applications of 1941 graduates must be in our file by May 30. Ample time should be allowed for securing all data required. For application forms and further information, apply to

LEON M. CHILDERS, *Secretary,*
1312 First Nat'l Bank Bldg.,
Lexington.

LOUISIANA STATE BOARD OF DENTISTRY

THE Louisiana State Board of Dentistry will hold its next general examinations of candidates at Loyola University of the South, in New Orleans, June 9-14. For further information and application blanks, address

B. J. LACOUR, *Secretary,*
Welsh.

MAINE STATE BOARD OF DENTAL EXAMINERS

THE next meeting of the Maine State Board of Dental Examiners will be held June 23-25 at the State House, Augusta. Applications with necessary fee must be in the hands of the secretary at least ten days prior to the date of examination. Address all communications to

CARL W. MAXFIELD, *Secretary,*
31 Central St.,
Bangor.

MASSACHUSETTS BOARD OF DENTAL EXAMINERS

THE Massachusetts Board of Dental Examiners will hold its annual examinations June 9-12. All applications, with credentials, must be filed with the secretary at least thirty days in advance. For further information, address

FRANCIS M. CAHILL, *Secretary,*
State House,
Boston.

MISSISSIPPI STATE BOARD OF DENTAL EXAMINERS

THE Mississippi State Board of Dental Examiners will hold its next examination in Jackson beginning the third Tuesday in June. Applications should be in the hands of the secretary thirty days before the date of the meeting. For further information, address

G. L. CLEMENT, *Secretary,*
Pontotoc.

MONTANA STATE BOARD OF DENTAL EXAMINERS

THE regular annual meeting of the Montana State Board of Dental Examiners for the examination of applicants desiring to practice dentistry or dental hygiene will be held in Helena commencing July 14. Montana does not reciprocate with any of the other states or the territories. All applicants must be citizens of the United States and must have received a degree from a dental school in the United States offering a full four year course.

LEONARD A. JENKIN, *Secretary,*
401 Ford Bldg.,
Great Falls.

NEBRASKA STATE BOARD OF DENTAL EXAMINERS

THE Nebraska State Board of Dental Examiners will hold its next regular examination at Omaha and Lincoln, June 16-21. The practical examination will be given at Creighton University Dental School, Omaha, June 16-18; the theoretical, at the State House, Lincoln, June 20-21.

HENRY A. MERCHANT, *Secretary,*
Medical Arts Bldg.,
Omaha.

STATE OF NEW HAMPSHIRE DENTAL BOARD

THE New Hampshire State Dental Board will hold examinations for dentists June 12-14 at Manchester, and for hygienists June 21 at Concord.

OTIS M. LITTLEFIELD, *Secretary,*
913 Elm St.,
Manchester.

STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

THE State Board of Registration and Examination in Dentistry of New Jersey will hold its annual examinations, commencing June 23 and continuing for five days thereafter. On application to the secretary, a copy of the requirements and rules for applicants, instruction sheet and preliminary application blank will be sent. Any person desiring to apply as a candidate must file the preliminary application blank, together with the examination fee of $25, on or before March 15, for the succeeding June examinations or before September 1 for the succeeding December examinations.

W. A. WILSON, *Secretary,*
148 W. State St.,
Trenton.

NEW MEXICO BOARD OF DENTAL EXAMINERS

THE New Mexico Board of Dental Examiners will hold its next examination in Santa Fe, June 23-26. For further information, address

J. J. CLARKE, SR., *Secretary,*
Artesia.

NORTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

THE next annual meeting of the North Carolina State Board of Dental Examiners for the examination of applicants for licensure will be held at the State Capitol, Raleigh, beginning June 23. Applications must be filed with the secretary thirty days before the examination. For application blanks and further information, address

WILBERT JACKSON, *Secretary,*
Rich Bldg.,
Clinton.

NORTH DAKOTA STATE BOARD OF DENTAL EXAMINERS

THE North Dakota State Board of Dental Examiners will hold its next examination in the Gardner Hotel, Fargo, July 7-10. For information and application, address

L. I. GILBERT, *Secretary,*
401 Black Bldg.,
Fargo.

OHIO STATE DENTAL BOARD

THE next examination of the Ohio State Dental Board will be held the week beginning June 23. All applications must be in the hands of the secretary at least ten days before the date of examination. For further information, address

EARL D. LOWRY, *Secretary,*
79 E. State St.,
Columbus.

STATE OF OKLAHOMA DENTAL BOARD

THE Board of Governors of Registered Dentists of the State of Oklahoma will hold its next examination in Oklahoma City, June 16-19. Applications for examination in dentistry, dental hygiene and dental specialties must be received by June 10. Address all communications to

W. T. LONGWELL, *Secretary,*
1st National Bank Bldg.,
Frederick.

DENTAL COUNCIL AND EXAMINING BOARD OF THE COMMONWEALTH OF PENNSYLVANIA

THE Dental Council and Examining Board of the Commonwealth of Pennsylvania will conduct examinations in Philadelphia and Pittsburgh, June 17-21. For information and

application blanks, address the Department of Public Instruction, Bureau of Professional Licensing, Dental Division, Harrisburg, or

REUBEN E. V. MILLER, *Secretary,*
61 N. Third St.,
Easton.

SOUTH DAKOTA BOARD OF DENTAL EXAMINERS

THE South Dakota State Board of Dental Examiners will hold its next examination at Rapid City, June 18-21. For information and applications, address

C. H. BOYDEN, *Secretary,*
Mitchell.

TEXAS BOARD OF DENTAL EXAMINERS

THE Texas Board of Dental Examiners will hold its next examination June 16-20 in Dallas. Applications must be filed at least ten days prior to the date of examination. For further information, address

B. CARL HOLDER, *Secretary,*
Nixon Bldg.,
Corpus Christi.

VERMONT STATE BOARD OF DENTAL EXAMINERS

THE Vermont State Board of Dental Examiners will meet June 23-25 in the State House, Montpelier, to examine applicants for license to practice dentistry and dental hygiene. All applications, accompanied by examination fee, must be in the hands of the secretary at least fifteen days before the date of the meeting. For applications and other information, address

C. I. TAGGART, *Secretary,*
Burlington.

VIRGINIA STATE BOARD OF DENTAL EXAMINERS

THE next regular meeting of the Virginia State Board of Dental Examiners will be held at the Medical College of Virginia, Richmond, beginning at 9 a.m., June 10. Applicants are required to present a certificate from the Virginia State Board of Education showing that they have had one year of academic education equal to one year of college work; must be graduates of a class A dental college or university, and must be prepared to do any kind of practical or operative work necessary in the general practice of dentistry. The theoretical examination covers subjects usually found in a complete dental curriculum. Applications, with fee and photograph, must be filed complete fifteen days before the examination. For application blanks and further information, apply to

JOHN M. HUGHES, *Secretary,*
715 Medical Arts Bldg.,
Richmond.

WEST VIRGINIA BOARD OF DENTAL EXAMINERS

THE West Virginia State Board of Dental Examiners will hold its next examination at the Capitol Building, Charleston, beginning the fourth Monday in June. Applications should be in the hands of the secretary thirty days before the date of the meeting. For further information, address

HENRY C. HILL, *Secretary,*
Charleston.

WISCONSIN BOARD OF DENTAL EXAMINERS

THE next meeting of the Wisconsin Board of Dental Examiners will be held at Marquette University Dental School June 16-20. Candidates having graduated prior to January 1 must have applications filed not later than May 15. Candidates who are 1941 graduates must have applications filed not later than June 1. For further information, address

S. F. DONOVAN, *Secretary,*
Tomah.

DENTAL INTERNSHIP

THE Utah State Hospital, Provo, wishes to procure a dental intern, preferably a resident of Utah graduating this spring. The internship is for a year or more of full-time service. For particulars, address

GARLAND H. PAGE, *Superintendent,*
Utah State Hospital,
Provo.

EXAMINATION FOR APPOINTMENT IN THE DENTAL CORPS OF THE NAVY

A COMPETITIVE examination to select candidates for appointment in the Dental Corps of the Navy will be held July 7 at the Naval Medical School, Washington, D. C., the Naval Training Station, Great Lakes, Ill., and the Naval Training Station, San Diego, Calif. A candidate for appointment in the Dental Corps must be a citizen of the United States, between 21 and 32 years of age at the time of appointment, and a graduate

of a standard dental college. A circular which contains full information relative to the Dental Corps and describes the method of making application for appointment can be obtained from the Bureau of Medicine and Surgery, Navy Department, Washington, D. C.

CARNEGIE FELLOWSHIPS FOR RESEARCH AND GRADUATE WORK IN THE DENTAL SCIENCES

AIDED by the Carnegie Corporation, the School of Medicine and Dentistry of the University of Rochester offers scholarships paying $1,200-$1,800 per annum to well-trained dental graduates who are interested in research or who desire special training in the basic medical sciences as an aid to dental teaching or practice. A few fellowships also offer part-time training in oral surgery. On appointment, the applicant is given the title of Carnegie Dental Fellow and, according to his interest, works as a graduate student in one of the departments of the medical school. Here, excellent laboratory facilities, adequate direction and close contact with various investigations related to medicine and dentistry help his research and study. Fellows are encouraged to attend medical classes, seminars and staff meetings and, when opportunity presents itself, to participate in class instruction and scientific meetings. Contact with the problems of clinical dentistry may be maintained through the Oral Surgery Clinic of the Strong Memorial Hospital and the Rochester Dental Dispensary. With the approval of the Graduate Council of the university, Fellows may prepare themselves for the degree of M.S. or Ph.D. Application should be made to

GEORGE H. WHIPPLE, *Dean,*
School of Medicine and Dentistry,
University of Rochester,
Rochester, N. Y.

COLUMBIA UNIVERSITY COURSE IN HISTOPATHOLOGY

COLUMBIA University announces a special course on the histopathology of the periodontal tissues to be given under the direction of Bernhard Gottlieb, of Vienna and Ann Arbor (the University of Michigan), assisted by members of the divisions of periodontology, dental histology and dental pathology of the School of Dental and Oral Surgery, Columbia University, under the university extension plan, June 23-27. For further information and applications, address the Assistant to the Registrar, School of Dental and Oral Surgery, Columbia University, 630 W. 168th St., New York.

POSTGRADUATE COURSES, SCHOOL OF DENTISTRY, UNIVERSITY OF LOUISVILLE

THE School of Dentistry, University of Louisville, Louisville, Ky., offers postgraduate courses in oral surgery, periodontia, dentistry for children, casting procedures, complete denture prosthesis and oral diagnosis and medicine during the week of June 23-28. For further information, address the Committee on Postgraduate Education, School of Dentistry, University of Louisville.

ROBERT L. SPRAU, *Chairman,*
Committee on Postgraduate Education.

RESIDENCY IN DENTAL MEDICINE

THE University of Oregon Medical School Hospitals and Clinics offer a residency in the Division of Dental Medicine and Oral Surgery. Appointment will be made about the first of December. The period of service is for one year, July 1 to June 30. Compensation is $40 a month in addition to board, room and laundry. The division is under the general direction of the Department of Medicine. Its service is carried on in several units: 1. The General Outpatient Clinic. 2. The Multnomah Hospital. 3. The Doernbecher Children's Hospital. 4. The University State Tuberculosis Hospital. Service is under the direct supervision of the head of the division and a visiting staff of sixteen dentists. Application blanks will be furnished on request to

RICHARD B. DILLEHUNT, *Dean,*
University of Oregon Medical School,
Portland.

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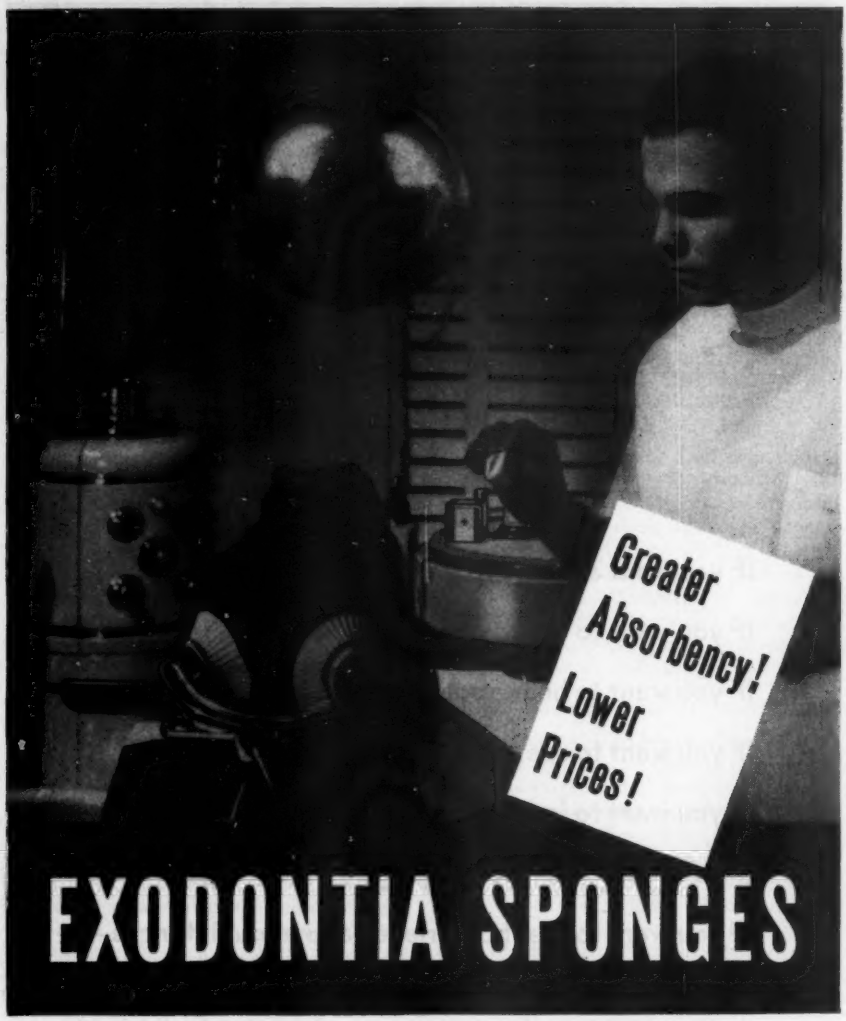

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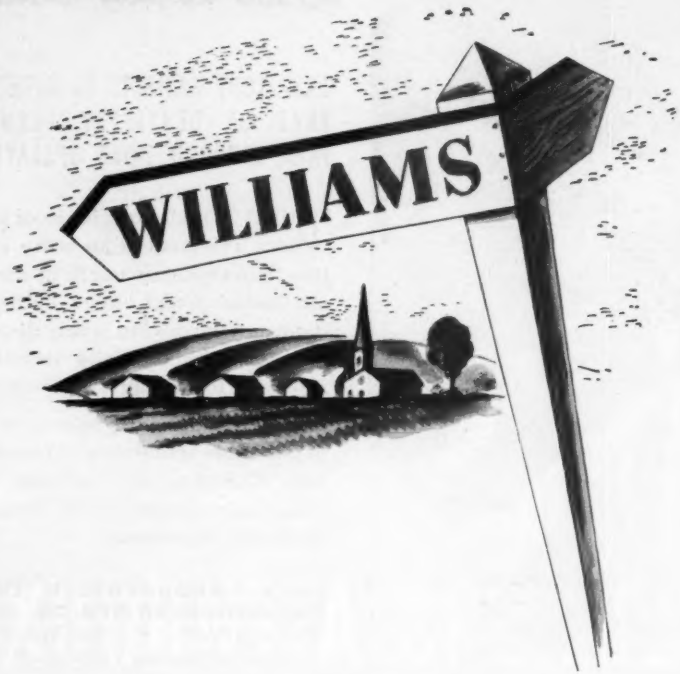
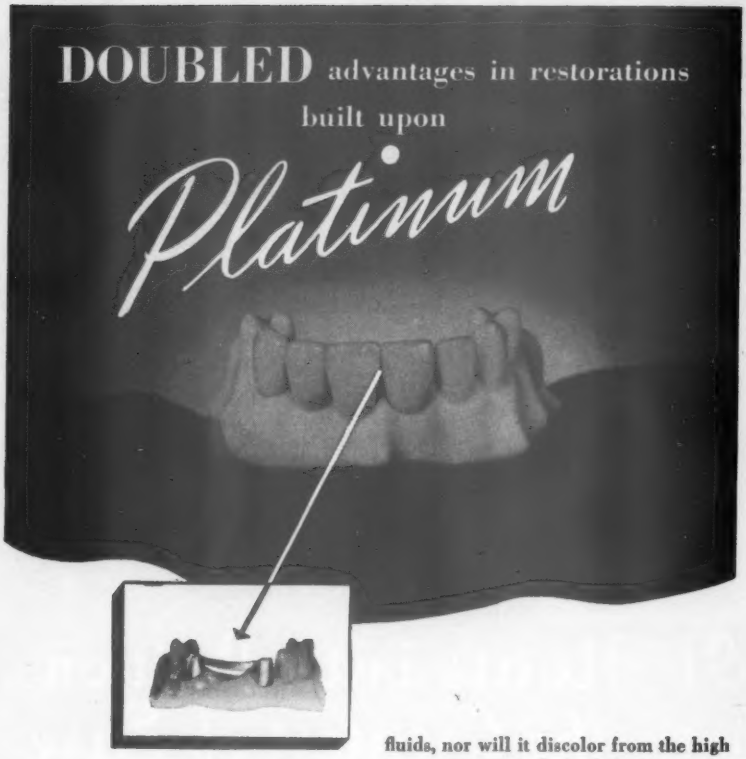


TO BETTER DENTISTRY

★ ★ ★ ★

WILLIAMS "6" ALL-PURPOSE CASTING GOLD

DOUBLED advantages in restorations built upon *Platinum*



Unexcelled **in beauty . . . approaching Nature's own creation . . . porcelain bridgework represents the highest order of dental esthetics.**

No other metal combines the advantages of platinum for frames, jacket cores, precision attachments and other parts of porcelain bridgework. Platinum is strong and it *can't* tarnish in oral fluids, nor will it discolor from the high temperatures used in baking on the porcelain.

Platinum is preeminent in dentistry not only for porcelain bridgework. Most well-known dental golds are strengthened by platinum and made more resistant to tarnish and more responsive to heat treatment. Cast or wrought, platinum-palladium-golds are always readily workable and are obtainable in colors ranging from golden-yellow to platinum-white.

Platinum Metals Division

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street, New York, N. Y.

It Floats into Position with the Greatest of Ease

proof X-Ray, for ... of the finger controls ... to place it exactly where ... wants it.

Ball bearing assemblies completely eliminate friction and wear—thus assuring an exactness and a smoothness comparable to floating on air. Balls and races are sealed and forged for lifetime endurance. They require no adjustment . . . no lubrication . . . always remain silent in operation.

... will explain all its ... and how it produces ... radiographs with each exposure. He will gladly tell you, too, how Ritter aids the dentist to increase his income through the Ritter X-Ray Practice Building Service.

Ritter

Dental Manufacturing Co., Inc.

Ritter Park Rochester, N. Y.

The Only Dental X-Ray with an Air-Cooled Tube in a Shockproof Head

VARIED LABIAL SURFACES

Another Contour that Contributes to the Personality of the Tooth . . .

CERVICO-INCISAL CONTOUR

This contour is not as varied as the mesio-distal contour. The high point of the curve is the position of the horizontal highlight.

There is no fixed correlation between the mesio-distal and the cervico-incisal contours. There are innumerable combinations of the curves of the two directions.

Variations of the labial surfaces are the bases of esthetics, and the first and only artificial teeth to embody the varied labial surfaces in natural teeth are

VERI-CHROME

TRADE MARKS REG. U. S. PAT. OFF.

Five Phase Anteriors

Specify them on your next case

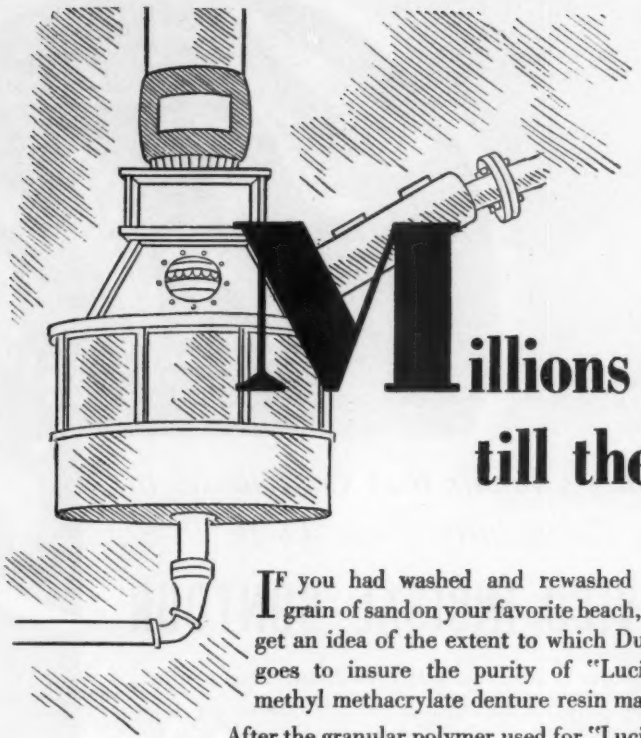
Look for the trade mark ⬠ *on the lingual of each tooth*

Use your VERI-CHROME COLOR GUIDE —it will eliminate all guesswork in both partial and full denture work.

UNIVERSAL DENTAL COMPANY

MANUFACTURERS OF THE MOST COMPLETE LINE OF PORCELAIN TEETH

48th & BROWN STREETS • PHILADELPHIA • PA.



Millions of till their

IF you had washed and rewashed every grain of sand on your favorite beach, you'd get an idea of the extent to which Du Pont goes to insure the purity of "Lucitone" methyl methacrylate denture resin material.

After the granular polymer used for "Lucitone" has been formed from the basic monomer, it is subjected to a special washing process at the Du Pont plant. Only specially treated water is used, and every single batch of polymer is washed not once but five separate times. Any polymerizing agents which may remain on the surface of the granules from the polymerizing process come out in the wash. Not a single impurity can remain to cause ultimate harm in the mouth.

To supply the specially treated water used in this process, an entire room at the Du Pont plant is required. This room houses the water purifica-

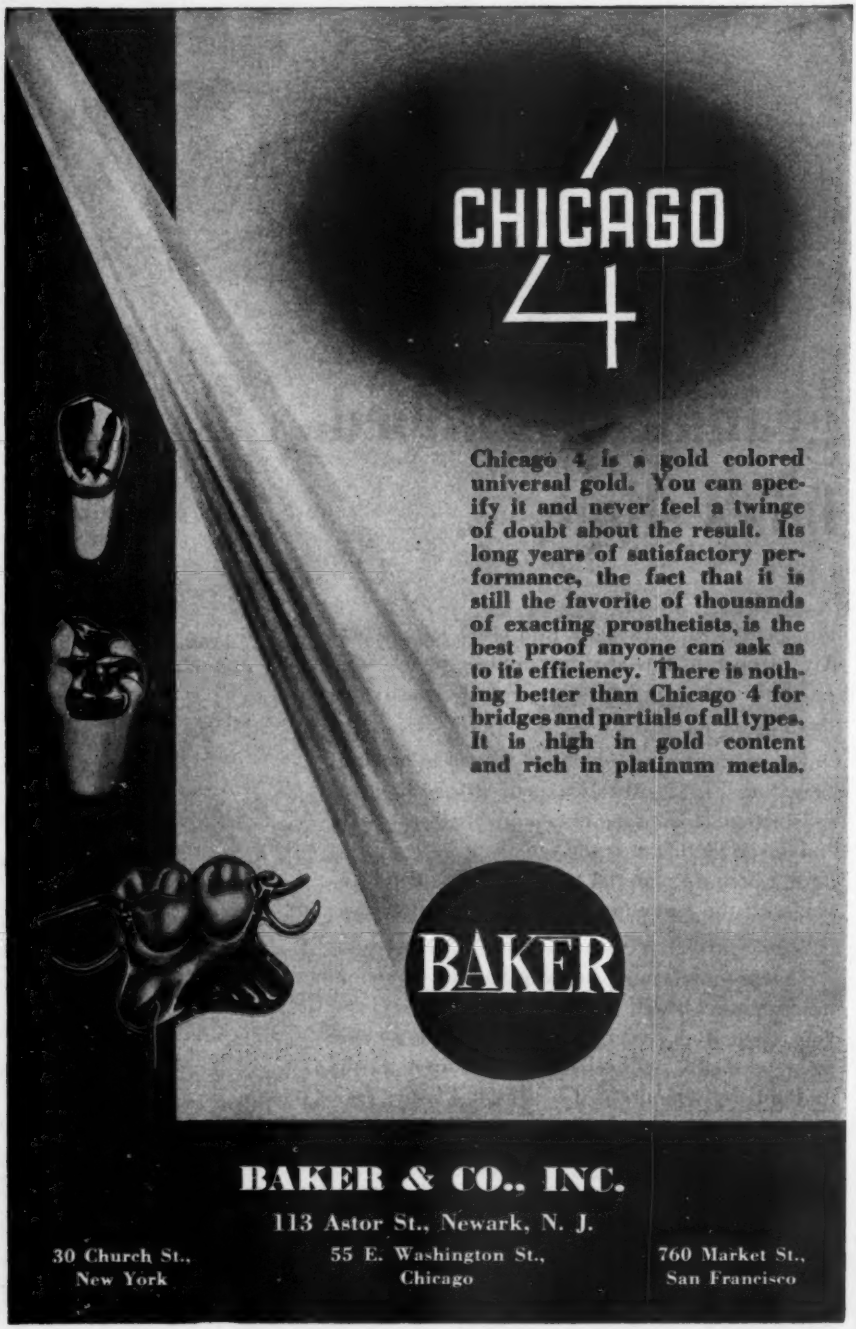
granules–scrubbed faces shine

tion plant with a capacity of 15,000 gallons per day to operate this washing process, which was especially developed to safeguard the purity of this type of plastic.

The extra measure of care exercised in making "Lucitone" isn't entirely expended for our own satisfaction. Elaborate tests and analyses have convinced us that it is the only way we can produce a denture material which can be offered to you with the assurance that you may safely use it in your patient's mouth.

That process is more costly, naturally. But your peace of mind is well worth the little more it costs you when you specify "Lucitone," an acrylic resin specially synthesized for dentures. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J.

"Lucitone" denture material is the only methyl methacrylate resin denture material made by Du Pont. "Lucitone" is distributed solely by The L. D. Caulk Company, Milford, Delaware.


CHICAGO 4
Chicago 4 is a gold colored universal gold. You can specify it and never feel a twinge of doubt about the result. Its long years of satisfactory performance, the fact that it is still the favorite of thousands of exacting prosthetists, is the best proof anyone can ask as to its efficiency. There is nothing better than Chicago 4 for bridges and partials of all types. It is high in gold content and rich in platinum metals.
BAKER
BAKER & CO., INC.
113 Astor St., Newark, N. J.
30 Church St., New York
55 E. Washington St., Chicago
760 Market St., San Francisco

TWO FAMOUS WAXES
both Blue - both by KERR

Long experience in compounding Dental Waxes has enabled the Kerr organization to produce for you a quality and variety of Kerr Waxes not duplicated by any other manufacturer.

Most widely known of these products is Kerr Blue Inlay Casting Wax, for many years the Profession's preferred reliance.

Kerr Blue Inlay Casting Wax (Regular), supplied as sticks, softens at slightly lower temperatures than Kerr Blue Inlay Casting Wax (Hard), which comes as sticks or pyramids. Either will produce for you a splendid pattern of the prepared cavity.

These Kerr Waxes harden at mouth temperature and carve readily without chipping. Color contrast clearly defines all margins. Each burns out completely and without residue.

Choose the type and shape which best fits your needs.

KERR DENTAL MFG. CO.
DETROIT
ESTABLISHED 1891

KERR
REG. U.S. PAT. OFF.

BLUE INLAY
CASTING WAX

S. S. WHITE PLASTIC

You can save $16.25 by

★ The handsome, serviceable correspondence tray is offered *free*—ideal for office or home use.

OUTFIT No. 48 ★ ★

by purchasing this outfit now!

The S. S. WHITE PLASTIC OUTFIT NO. 48 contains an assortment of carefully selected products used daily in your office. Each product is noted for its high quality and the complete satisfaction it gives. The outfit affords an opportunity to replenish your stock of these often needed items and save considerable at the same time.

Here's what the outfit contains

- *10 Ounces True Dentalloy A Cut or Regular Cut (2 5-oz. bottles)
- 1 Ounce True Dentalloy Sigrens
- 1 Mercury Dispenser with empty ¼ lb. Mercury Bottle
- 7 Filling Porcelain Improved Powders
  - **Full Portions**
  - 1 No. 20, Pale Yellow
  - 2 No. 21, Light Yellow
  - 1 No. 22, Yellow
  - 1 No. 23, Pale Yellow-Gray
  - 1 No. 24, Yellow-Gray
  - 1 No. 26, Gray-Yellow
- 1 Trial Portion Filling Porcelain Improved, Powder No. 21
- 3 Bottles Filling Porcelain Improved Liquid
- 1 Trial Portion Filling Porcelain Improved Liquid
- 1 Bottle Cavity Lining and Varnish with Solvent
- 4 Powders Zinc Cement Improved
  - **One Full Portion Each**
  - No. 11, Pure White
  - No. 12, Tooth Yellow
  - No. 13, Incisal Gray
  - No. 14, Gingival Brown
- 2 Powders S. S. White Red Copper Cement
- 1 Powder Silver Cement Improved
- 4 Bottles Liquid for Zinc Cement Improved, Silver Cement Improved, and Red Copper Cement
- 10 Tubes Elastic Colloid

The above items more than comply with A.D.A. Specifications.

*Specify True Dentalloy Cut A or Regular at time of ordering.

VALUE $64.25 (not including Trial Powder and Liquid) **PRICE $48.00** **SAVING $16.25**

For Sale At Your Local Dealer

THE S. S. WHITE DENTAL MFG. CO.

PHILADELPHIA, PA.

PHYSICIANS CASUALTY ASSOCIATION
PHYSICIANS HEALTH ASSOCIATION

HOSPITAL
ACCIDENT
SICKNESS

INSURANCE

For Ethical Practitioners Exclusively
(56,000 POLICIES IN FORCE)

LIBERAL HOSPITAL EXPENSE COVERAGE FOR $10.00 PER YEAR

$5,000.00 accidental death $25.00 weekly indemnity, accident and sickness	For $33.00 per year
$10,000.00 accidental death $50.00 weekly indemnity, accident and sickness	For $66.00 per year
$15,000.00 accidental death $75.00 weekly indemnity, accident and sickness	For $99.00 per year

39 years under the same management

OVER $2,000,000. INVESTED ASSETS
OVER $10,000,000. PAID FOR CLAIMS

$200,000 deposited with State of Nebraska for protection of our members

"86 cents of each $1.00 of gross income is used for members' benefits"

Disability need not be incurred in line of duty—benefits from the beginning day of disability

Send for application, Doctor, to

400 FIRST NATIONAL BANK BLDG., OMAHA, NEBRASKA

Grapefruit and Pyorrhea

Although there are many theories as to the exact causes of tooth decay, there is ample clinical evidence that the incidence of dental caries and pyorrhea is far less when the diet includes sufficient quantities of natural foods containing the essential vitamins and mineral salts.

Leading investigators have found that a diet lacking in Vitamin C often precedes the onset of pyorrhea.

Citrus fruits are of great value in the formation of sound teeth and healthy gums, and help them to remain so. Grapefruit, either fresh or canned, constitutes an economical year-round supply.

Grapefruit is a prime source of ascorbic acid (Vitamin C), as well as an appreciable source of other vitamins and mineral salts.

Recent research has shown that this fruit is one of the least costly food sources of Vitamin C. At current prices, grapefruit juice supplies Vitamin C at a cost less than that of the synthetic product.

Members of the dental profession desiring a complete and authoritative documentation on the nutritional values of grapefruit are invited to use the coupon for a free copy of "Citrus Fruits and Health," recently published by the Florida Citrus Commission.

FLORIDA CITRUS COMMISSION
STATE OF FLORIDA

Florida Citrus Commission DEPT. 35-P
Lakeland, Florida
Gentlemen:

Please send me your book, CITRUS FRUITS AND HEALTH.

Name_____

Address_____

City_____ State_____

Profession_____

HAVE YOU REQUESTED YOUR COPY OF . . .

"ARABIAN NIGHTS IN DENTISTRY"?

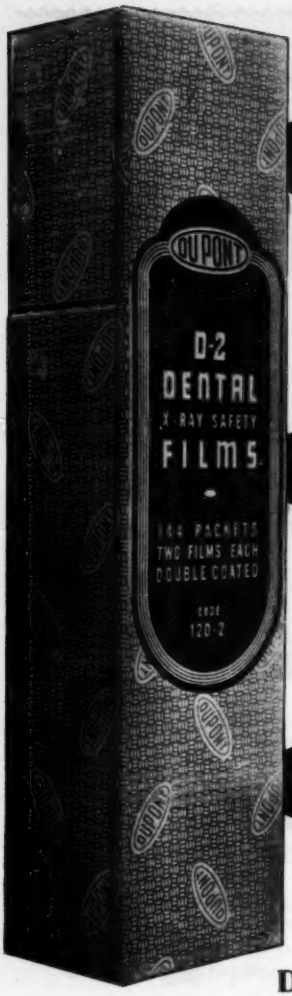
In "Arabian Nights in Dentistry" the story of restorative dentistry and its esthetic possibilities is interestingly and clearly related through the generous use of "before and after" pictures. A few of the many pictures employed are shown here.

"Arabian Nights in Dentistry" is unquestionably one of the most attractive books ever prepared for the education of a dental patient. You will use it often for the vivid manner in which it emphasizes the importance of good dentistry.

Phone or write your Ticonium Laboratory for a copy of this splendid book "Arabian Nights in Dentistry."

TICONIUM

413 NORTH PEARL ST., ALBANY, N. Y.



For Speed

A 25% more sensitive emulsion allows a corresponding reduction in exposure time.

For Contrast

Rich blacks and clear whites accentuate the definition of fine diagnostic detail.

For Easy Opening

Pull-A-Tab packets open quickly, facilitate darkroom handling.

DUPONT DENTAL X-RAY FILMS

"D" films are double coated. Their two emulsions give maximum speed and contrast. "S" films—single coated—are more economical. They give a long scale gradation with a wealth of intermediate tones. Both films are made on Du Pont Safety Blue Base. Both are identifiable by the "shiny side, tongue side" method. Packets containing either one or two films each are available through leading dental supply dealers. For rapid processing use Du Pont Concentrated X-ray Chemicals.

DuPont Film Mfg. Corp., 9 Rockefeller Plaza, New York, N. Y.

Better Films for Better Radiographs

blessings [illegible]on thee little man...

The blessings of sunlight and simple, quiet existence are often beyond the realization of today's children. Numerous cases of borderline deficiencies are being constantly observed by the profession.

Studies* in groups of all ages have shown that COCOMALT added to the diet results in substantial gains. The vitamin-mineral character of COCOMALT supplies important nutrients in diets of young and old . . . vital elements that must be present in optimal amounts to insure vibrant health. COCOMALT is a *delicious* beverage that acts as an incentive to drink more milk.

Cocomalt . . . contains calcium, phosphorus, iron, vitamins A, B_1, D, G . . . Quick energy and body building nutrients.

COCOMALT-DELICIOUS MALTED FOOD DIETONIC FOR ALL AGES

R. B. DAVIS COMPANY, HOBOKEN, N. J.

*Archives of Pediatrics—56:Nov., 1939
Medical Record—Aug. 21, 1940

Journal Income Is Used to Protect Your Livelihood

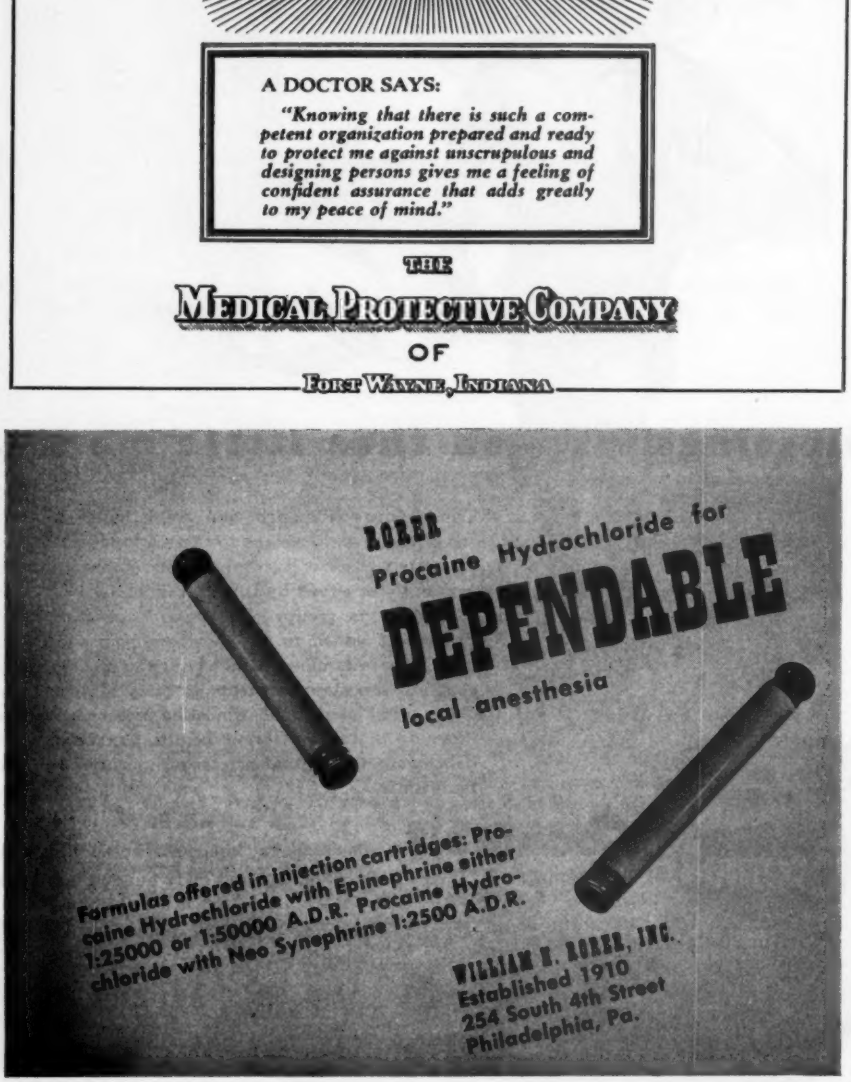
PROFESSIONAL PROTECTION

SINCE 1899
SPECIALIZED
SERVICE

A DOCTOR SAYS:

"Knowing that there is such a competent organization prepared and ready to protect me against unscrupulous and designing persons gives me a feeling of confident assurance that adds greatly to my peace of mind."

THE
MEDICAL PROTECTIVE COMPANY
OF
FORT WAYNE, INDIANA


ROBER
Procaine Hydrochloride for
DEPENDABLE
local anesthesia
Formulas offered in injection cartridges: Procaine Hydrochloride with Epinephrine either 1:25000 or 1:50000 A.D.R. Procaine Hydrochloride with Neo Synephrine 1:2500 A.D.R.
WILLIAM R. ROBER, INC.
Established 1910
254 South 4th Street
Philadelphia, Pa.

2 Types of EASTMAN PROCESSING CHEMICALS

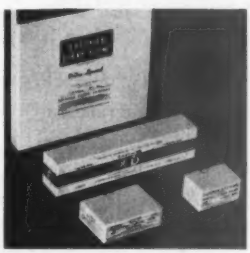
• Concentrated Liquids • Prepared Powders

No matter how you prefer to make your x-ray processing solutions—from concentrated liquids or from prepared powders—Eastman can provide you with chemicals that meet the highest standards.

Concentrated x-ray developer and concentrated x-ray fixer are supplied in bottles, each containing sufficient liquid to make 1 gallon of solution by the addition of water. X-ray developer and x-ray fixer in powder form are supplied in containers, each holding a quantity sufficient to make 1 gallon of solution when dissolved in water.

Both the liquids and the powders are prepared with laboratory care, from Eastman Tested Chemicals . . . they both provide stable solutions. A standing order with your dental dealer will assure regular deliveries . . . remind you to replace your processing chemicals at the most advantageous time.

EASTMAN KODAK COMPANY
Medical Division Rochester, N. Y.

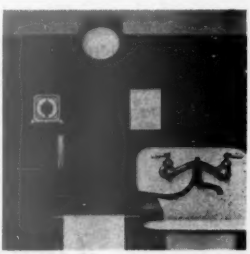


Also . . . A Complete Line of FILMS

PERIAPICAL (four types)—R-P (Rapid-Processing), Radia-Tized, C (Regular-Slow), CC (Extra-Fast); 1- and 2-film packets. **BITE-WING**—1-film packets; four sizes. **OCCLUSAL** (two types)—Super Speed, Regular-Slow; 2-film packets. **EXTRA-ORAL** (two types)—Blue Brand Ultra-Speed, No-Screen; 8″ x 10″ and 5″ x 7″.

And . . . A Complete Line of ACCESSORIES

Film dispenser, film receptacle. Intra-oral cassette, intensifying screens, exposure holders. Processing room paints and complete equipment—safelight lamps, safelights, tanks, hangers, timers, thermometers, engraved graduates, ventilator, and other specially designed items. Mounts for *Bite-Wing* and periapical radiographs, illuminator.



EASTMAN X-RAY MATERIALS

***A complete line of* Films • Chemicals • Accessories**

The Newer Concepts of Meat in Nutrition

Meat . . .

and Its Role in the Prevention of Nutritional Anemia

AFTER the fifth or sixth month of life the iron reserve stored in the liver of the newborn is depleted. Thereafter the infant is entirely dependent on dietary intake for his iron needs. At the end of the second year,[1] at the termination of the critical period during which rapid growth has made heavy demands on the available iron, hypochromic microcytic anemia is of frequent occurrence. Children maintained on iron-deficient diets because of anorexia, allergy, diarrhea or other disorders invariably develop anemia of this type.

To prevent nutritional anemia, maintenance of the iron intake at a high level is essential. The average requirement, including a 50% addition as margin of safety, has been placed at 0.27 mg. per pound of weight for children between 2½ and 6 years of age.[2] The iron requirement of children over 6 has been estimated to be the same as that of the adult, 12 mg. daily.

The daily ingestion of meat aids greatly in meeting the iron requirements. It also supplies copper necessary for iron utilization. Hence meat is valuable in the prevention and treatment of nutritional anemia. Meat is usually acceptable to the child, though other iron-rich foods may be refused, and rarely loses its appetite appeal.

1. Food and Life, Yearbook of Agriculture, United States Government Printing Office, 1939, p. 201.
2. Ascham, Leah: A Study of Iron Metabolism with Preschool Children, J. Nutrition *10*:337 (Sept.) 1935. Daniels, A. L. and Wright, O. E.: Iron and Copper Retentions in Young Children, J. Nutrition *8*:125 (Aug.) 1934. Rose, M. S.; Vahlteich, E. M.; Robb, Elda, and Bloomfield, E. M.: Iron Requirement in Early Childhood, J. Nutrition *3*:229 (Nov.) 1930.

ACCEPTED AMERICAN MEDICAL ASSN. Council on Foods

The Seal of Acceptance denotes that the statements made in this advertisement are acceptable to the Council on Foods and Nutrition of the American Medical Association.

American Meat Institute
CHICAGO

"Every once in a while an outstanding dental book appears—well planned, well written, well illustrated and thorough. 'Crown and Bridge Prosthesis' by Tylman is such a book."

Says THE PENNSYLVANIA STATE DENTAL JOURNAL
Reviewing

Theory and Practice of
CROWN *and* BRIDGE PROSTHESIS

By STANLEY D. TYLMAN, Professor of Prosthetics, Head of the Department of Fixed Partial Dentures, University of Illinois, College of Dentistry, Chicago, Illinois.

815 pages, 1,000 illustrations, 9 color plates.
PRICE, $10.00.

When you meet up with a book that is so warmly approved, the question of whether you can afford it is relegated to the background. "CAN YOU AFFORD TO BE WITHOUT IT?" is the real question. Our convenient Pay As You Read Plan makes it possible for you to get the book immediately without a down payment—and you pay for it as you use it in installments of only $3.00 a month.

Tylman's book is extremely comprehensive in its coverage—this coverage ranging from the meaning and purpose of crown and fixed partial denture prosthesis, through examinations, preparation of teeth for crowns and retainers, construction of crowns, to instructions for the patient. It covers all phases of this rather broad subject.

The arrangement of the book follows the general plan of teaching this subject as recommended by the Curriculum Survey Committee of the American Association of Dental Schools. Emphasis is placed on the importance of an analysis of the need for crown and bridge service, the more desirable and economic manner to render this service, and the relation of fixed partial denture prosthesis to the other subjects in the dental curriculum and to dental practice.

Other MOSBY Dental Books

ORAL PATHOLOGY—By Kurt H. Thoma. 1,336 pages, 1,370 illustrations, 137 color plates. Price, $15.00.

DISEASES OF THE MOUTH — By Sterling V. Mead. 5th Ed. 1,050 pages, 633 illustrations, 63 color plates. Price, $12.50.

ORAL SURGERY — By Sterling V. Mead. 2nd Ed. 1,315 pages, 553 illustrations, 7 color plates. Price, $12.50.

COMPLETE DENTURES—By Merrill G. Swenson. 736 pages, 905 illustrations, 10 in color. Price, $10.00.

FRACTURES OF THE JAW IN PEACE AND WAR — By Horace Hayman Boyle. 288 pages, 127 illustrations. Price, $6.00.

TEXTBOOK OF EXODONTIA — By Leo Winter. 4th Ed. 510 pages, 475 illustrations, 2 color plates. Price, $10.00.

The C. V. Mosby Company ADA 6-41
3525 Pine Boulevard, St. Louis, Mo.

Gentlemen:
Send me Tylman's "CROWN AND BRIDGE PROSTHESIS," price, $10.00.

Also send me:_____
☐ Attached is my check. ☐ Charge my account.

*Dr.*_____

*Address*_____

AMERICAN DENTAL ASSOCIATION

OFFICE OF
DR. FRED A. RICHMOND
INSURANCE SECRETARY

HURON BUILDING
KANSAS CITY, KANSAS

June 1, 1941

TO ALL A.D.A. MEMBERS NOT PAST AGE 50:

Many applications for the A.D.A. Group Insurance are being received daily, and for the most part they are very carefully completed. This is highly appreciated by both this office and the Company.

It is to your advantage to answer each question as completely as possible because your application, alone, must represent you to the Company.

Life insurance is the one thing for sale that requires *more* than money to buy. Don't wait until it is too late for your application to make a good presentation for *you*. Apply now!

Fraternally yours,

Fred A. Richmond

Insurance Secretary, A.D.A.

IT'S TRUE, DOCTOR--

MAPS CHANGE, BUT

Steele's HIGH QUALITY IS CONSTANT

European War Lords have always tinkered with their boundaries and the map of Europe is subject to frequent changes—but these alterations never give complete satisfaction.

However, The Columbus Dental Mfg. Company has consistently maintained the policy of offering the profession HIGHEST QUALITY in Steele's Products. Today's most modern restorations are constructed with Steele's Interchangeable Teeth and Backings. Steele's Trupontic teeth properly adapted give you The Best Results, technically and esthetically. They offer lasting comfort and complete satisfaction to your patient.

SPECIFY TRUPONTICS ON YOUR NEXT BRIDGE CASE

THERE IS NO SUBSTITUTE FOR TRUPONTICS!

THE COLUMBUS DENTAL MANUFACTURING CO., COLUMBUS, OHIO, U. S. A.

Widen the Beneficial Circle

Q. *Can latent avitaminoses be prevented by diet?*

A. *Yes. These conditions can usually be avoided by a properly selected, varied diet. In formulation of such a diet, remember that foods selected from the some 375 varieties of canned products may have important places.* (1)

(1) "There is no known substitute for a steady, well balanced diet carrying liberal quantities of the protective foods. Such diets will provide all the known essential food nutrients in adequate amounts and in addition furnish some measure of safety against inadequacies of essentials about which there is at present no knowledge." J. Am. Med. Assn. 114, 548 (1940). American Can Company, 230 Park Avenue, New York, N. Y.

ACCEPTED AMERICAN MEDICAL ASS'N

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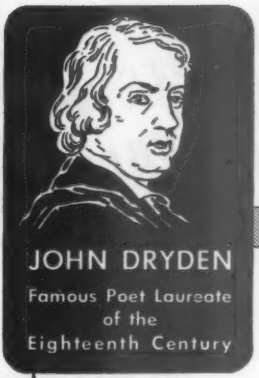


DRYDEN put it this way—

"To draw true beauty shows a master's hand"

and

THE HANDS OF THE MASTERS OF MODERN DENTISTRY USE

SYNTHETIC PORCELAIN

John Dryden had few literary equals in England's famous Restoration. And in esthetic restorations, Synthetic Porcelain is unexcelled!

Dentists everywhere appreciate Synthetic Porcelain's outstanding qualities—pleasing color matching, simplicity of technic, and proved durability in the restoration.

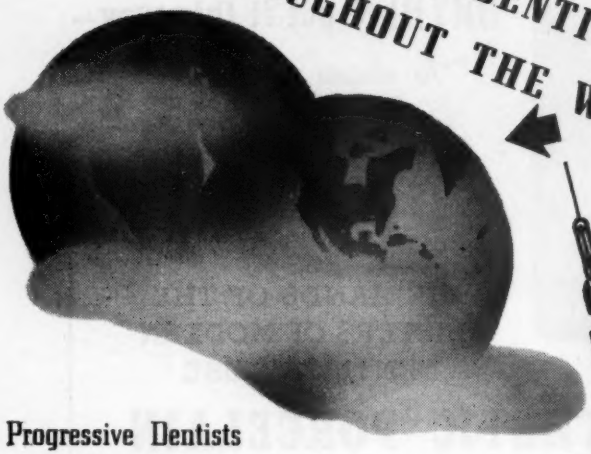
JUST TELL YOUR DEALER'S SALESMAN:

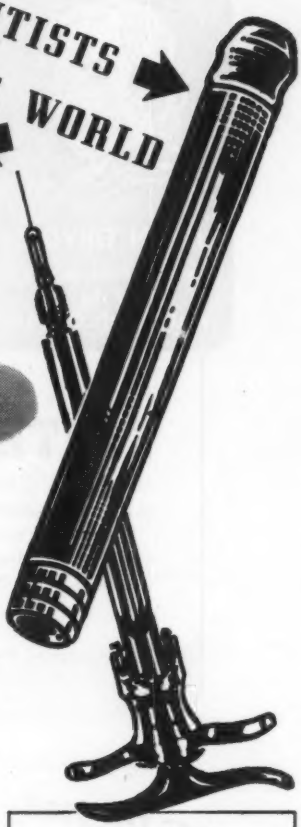
"I'd like to try Synthetic Porcelain without the slightest obligation to me."

He'll tell you about the special trial offer available in the new Demonstrator Package illustrated above.

FOR MODERN MATERIALS . . . CALL ON *Caulk* **MILFORD, DELAWARE**

USED BY DENTISTS THROUGHOUT THE WORLD





Progressive Dentists Prefer Proco-Sol Procaine Solutions

"Proco-Sol" Procaine Solutions with Neo-Synephrin or with Epinephrin are the choice of discriminating dentists throughout the world. Here are scientifically controlled local anesthetics that offer not only safety and uniformity, but also economy as well.

Procaine Hydrochloride has been combined with Epinephrin to give profound anesthesia for a prolonged period. Procaine has also been combined with Neo-Synephrin for the dentist who prefers a different type of a vaso-constrictor.

Write for Free Samples gladly sent upon request.

Accepted American Dental Association

Call your local dealer today . . . be sure to specify "PROCO-SOL" Procaine with Neo-Synephrin Hydrochloride, or with Epinephrin.

PROCO-SOL CHEMICAL COMPANY, INC.

1733 SPRING GARDEN STREET, PHILADELPHIA, PA.

Keep Your Office Cool-Quiet-Comfortable

on the hottest, most humid days!

with a new 1941

PHILCO-YORK

SINGLE-UNIT AIR CONDITIONER

MODEL 76-A (*Illustrated*)

- Cools and Conditions Room Air.
- Dehumidifies. Moisture is wrung out of the air, leaving it cool, dry, stimulating.
- Draws in Fresh, Outside Air.
- Filters Out Dirt, Dust and Pollen. A boon to hay fever sufferers!
- Circulates the Air.
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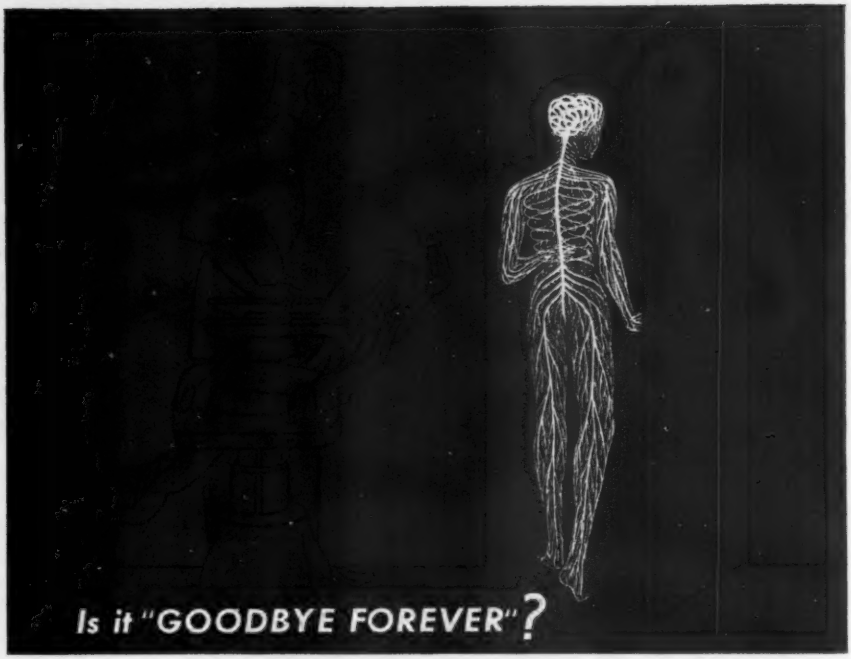

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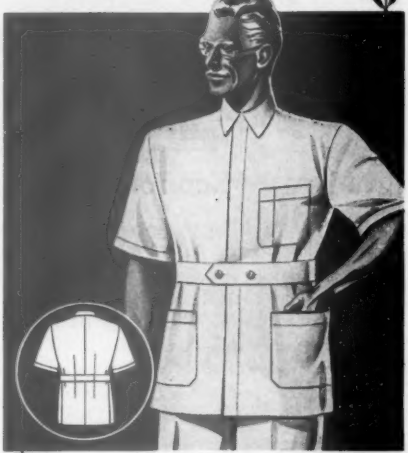

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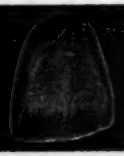

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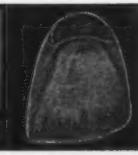

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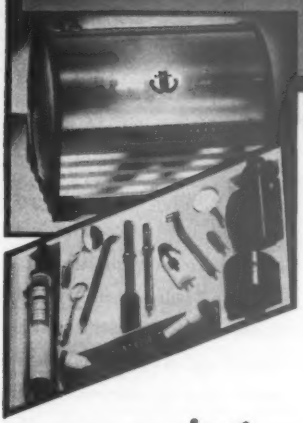

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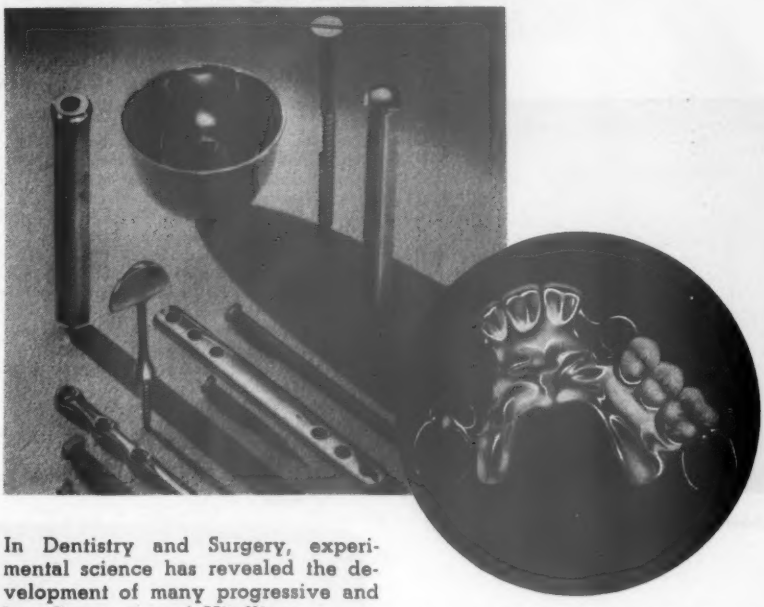

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**H. C. Berry, Journal of the American Dental Assn., March 1941; Alvin E. Strock, Bulletin of The Connecticut State Dental Assn., November 1940; P. Philip Gross, The Dental Digest, November 1940; Henry M. Bigelow, The Medical Bulletin of the Veterans' Administration, July 1940; H. C. Berry, Journal of the Arkansas State Dental Assn., June 1939.

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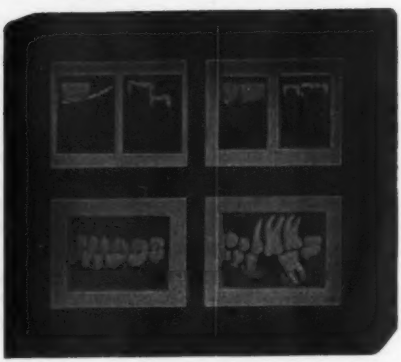

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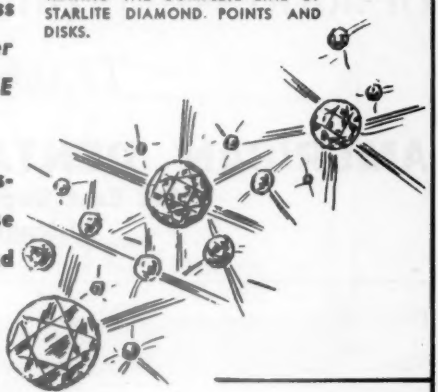

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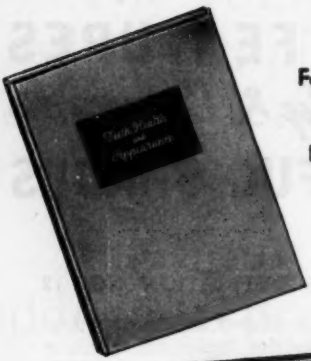

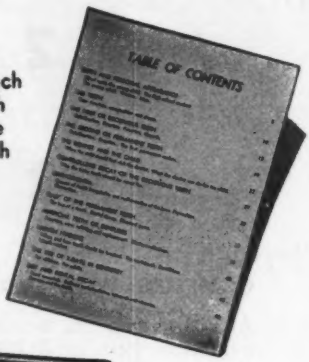

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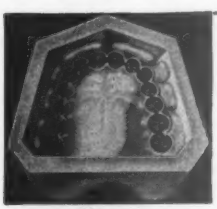

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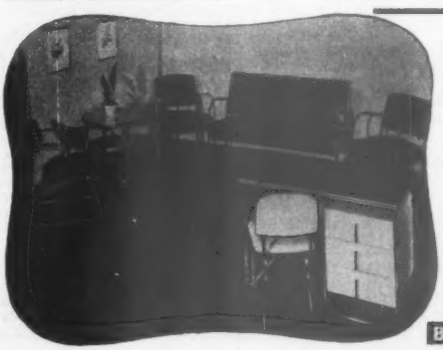

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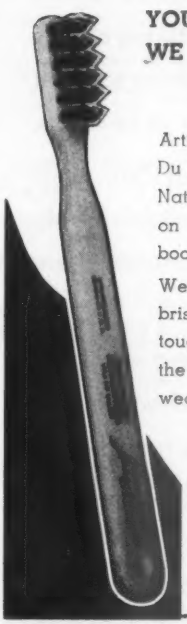

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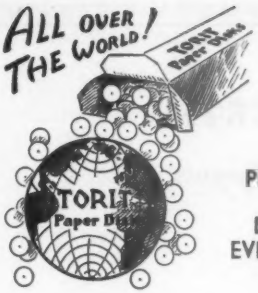

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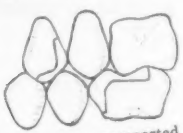
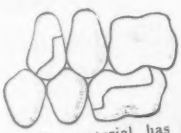


Do not leave unsupported and overhanging bulk of material.



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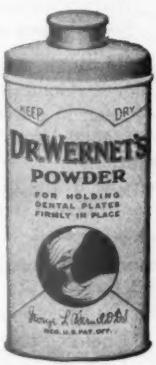

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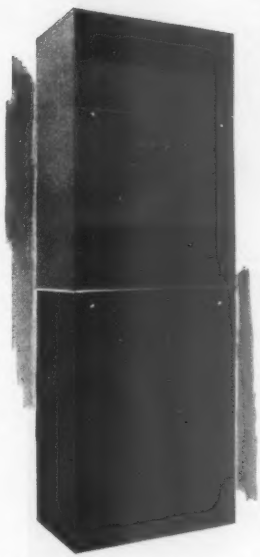

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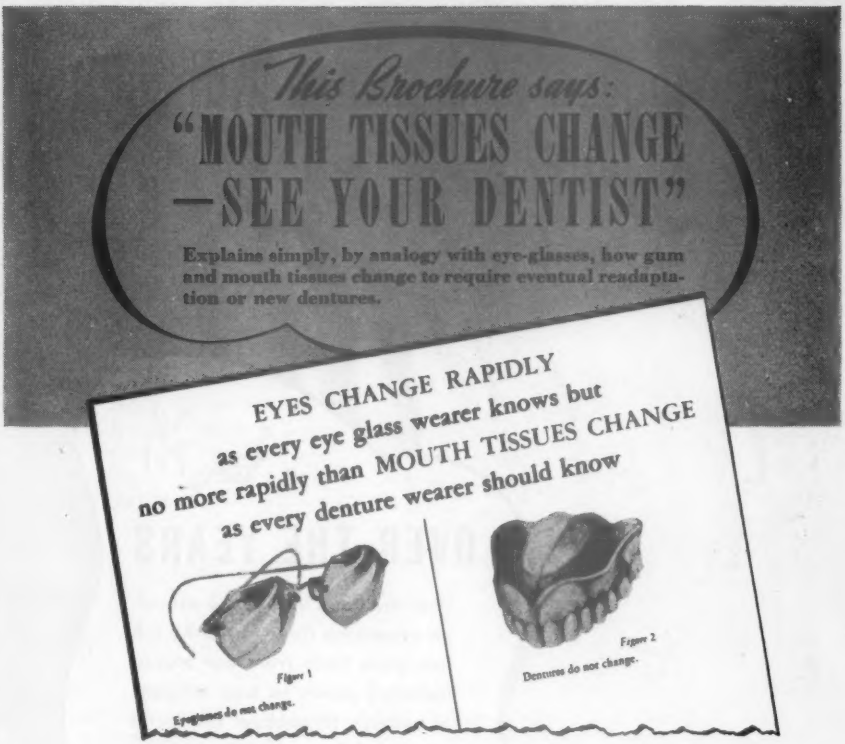
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